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For related information see also Astronautics.

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Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 269
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 270
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 270
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 271
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 271
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 272

Note: N.A. means that no abstracts were assigned to this category for this issue.

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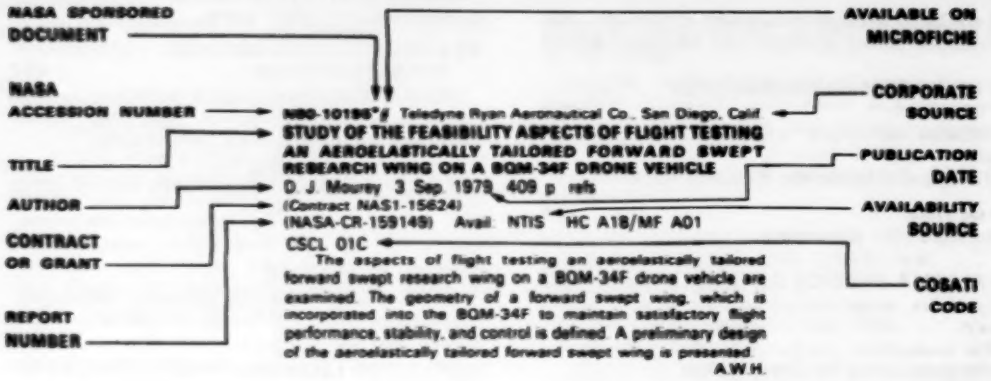
TYPICAL CITATION AND ABSTRACT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TITLE
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
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The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, MINI-RPV (REMOTELY PILOTED VEHICLE) ENGINE DEMONSTRATOR PROGRAM

M. Johnston, Teledyne Continental Motors, Aircraft Products Division, *P.O. Box 90, Mobile, Alabama* 36601 (DA0D4106; DAAJ02-77-C-0015)

Develop a lightweight, twin cylinder, two-stroke demonstrator engine which provides a technology base for future Army mini-RPV's. Address and solve existing problems of high weight, vibration levels, fuel consumption and short life.

Design, fabricate, test and deliver for government test five mini-RPV engines designed around currently available high-production engine components, i.e., pistons, cylinders, rods, etc. Make component modifications necessary to achieve the program goals of 1.2 lb/hp, 0.8 lb/hp-hr SFC, 150 hour life, operation to 12,000 foot density altitude.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0002, AN IMPROVED COMPUTER MODEL FOR PREDICTION OF AXIAL GAS TURBINE PERFORMANCE LOSSES

R.M. Jenkins, Tuskegee Inst., Graduate School, *Tuskegee Institute, Alabama* 36088 (NSG 3295)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0003, VISCOELASTIC BEHAVIOR OF THE INTERVERTEBRAL DISC RELATED TO EJECTION SHOCK

W.G. Knauss, California Inst. of Technology, Graduate School, Dept. of Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (DF046780; AFOSR-77-3139)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including flail and impact. The body in general and the musculoskeletal system particularly is adversely affected by these forces. This is of special importance in cases of ejection from high performance aircraft where the probability of disabling injury is unacceptably high. Deficiency - non-invasive techniques that may provide information about the mechanical performance of the human intervertebral disc do not exist. This information is important for the diagnosis as well as for the prevention of low back injuries, as may occur in aircraft ejections. This research seeks to set up the basis for the development of such a technique. Objective - the overall objective of this research is to improve the knowledge of the physiology and mechanical properties of the human intervertebral disc. How research contributes - this work should provide essential information to understand the short duration, transient loading problems of the spinal discs and contributes directly to subarea 1.6, 'aircrew safety and effectiveness in mechanical force environments' and will also be applicable to the fields of diagnostic, preventive and reparative medicine.

The researchers will delineate the inherent actions of the disc to mechanical load and define these physiologic and anatomical changes in terms of engineering parameters and constants. Experimentation will include for the coming year specimen preparation, relaxation of vertebral specimens subjected to a constant strain, and determination of the stiffness matrix for disc lamella.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0004, RESEARCH OF TUTORIAL CAPABILITY FOR THE USE OF LARGE STRUCTURAL ANALYSIS SYSTEMS

R.J. Melosh, Marc Analysis Research Corp., *260 Sheridan Ave., Suite 314, Palo Alto, California* 94306 (DF133220; F33615-78-C-3206)

The use of finite element analysis for the design of structural components contributes significantly to the effectiveness and efficiency of flight vehicles. The effective use of large structural analysis systems requires the user to devote a considerable effort and long calendar time to become familiar with its capabilities or consult some person who is an expert in its utilization. The objective of this effort is to explore the possibility of creating an expert consultant by utilizing the capabilities of a computer. The successful accomplishment of this objective will insure the ready capability to provide the analysis support for present and future aerospace systems, such as F-16, A-10, and YC-15 with a minimum analysis time.

A literature search has revealed that significant advances have been made in other scientific fields in using the methodology of production systems to create an expert consultant. The ideas of production systems will be utilized to investigate the possibility of creating an expert consultant for the use of large structural analysis systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, CONTROL OF V/STOL AIRCRAFT IN GROUND EFFECT

D.B. Debra, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NSG 2400)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0006, AERONAUTICAL TECHNOLOGY, TECH AREA 1 - AERODYNAMICS TECHNOLOGY

I.C. Statler, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Ames Research Center, *Moffett Field, California* 94035 (DA0B5000)

This project provides for technological development in rotary-wing fluid dynamics, acoustics, dynamics, stability, controllability and handling qualities where deficiencies are known to exist in meeting the requirements of future Army airmobile systems. Objectives are to develop handling quality design goals and performance criteria in terms required in future systems and to allow knowledgeable tradeoffs to be made among pilot workload, task performance and costs. This effort will lead to new design criteria and a revised handling qualities mil. spec. for helicopters. It is intended to contribute not only to the improvement of capabilities

in industry, but also to the development of the Army's in-house ability to assess the potential of new systems against predicted requirements.

These objectives will be reached through joint participation with NASA in theoretical and experimental research programs utilizing wind tunnel, ground-based simulation, and flight research capabilities.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0007, FLIGHT SOFTWARE REQUIREMENTS AND DESIGN SUPPORT SYSTEM

W.E. Riddle, University of Colorado, Boulder Campus, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NSG 1638)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0008, ENGINE/AIRFRAME/DRIVE TRAIN DYNAMIC INTERFACE DOCUMENTATION

W.J. Twomey, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0E3774; DAAJ02-77-C-0037)

The coupled interaction between two or more helicopter dynamic subsystems has often been the source of vibration problems. This is particularly true when considering the helicopter as a dynamic system in which excitations can be generated by any or all of the propulsion system, the airframe or the drive system. The problems of vibration-related interface compatibility in engine/drive system installations are usually complicated by the inherent coupling of the three (3) major multi-degree-of-freedom systems, i.e., engine, airframe and drive train. All background data and documentation of past experience lies in the hands of the airframe/engine industry, primarily the former. The technical objective of this contractual effort is to document industry experience to the degree required to permit plans/programs to be formulated as part of an overall government effort to accumulate data which will eventually lead to a solution of generic problems of this type.

Award sole source contracts to the major manufacturers of gas turbine powered US military helicopters, to review existing files, compile reports, memoranda, analytical design efforts, etc., and coordinate with appropriate engine manufacturers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0009, ACCIDENT INFORMATION RETRIEVAL SYSTEM (AIRS) INVESTIGATION

H. Ask, United Technologies Corp., Hamilton Standard Division, *Bradley Field Rd., Windsor Locks, Connecticut* 06096 (DA0E3843; DAAK51 78 C 0025)

Reduce Army aircraft accidents, enhance accident investigation validity and derive precise crashworthiness design criteria through the development and implementation of an accident information retrieval system that records flight and crash impact data.

AIRS detailed design, fabrication, component test, and system brassboard flight test in a Black Hawk helicopter memory module will be subjected to impact and fire survivability tests.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0010, ADVANCED COMPOSITES DESIGN PROGRAM

R.B. Pipes, University of Delaware, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Newark, Delaware* 19711 (DF140900; F33615-77-C-3132)

Advanced composite structures offer the potential of saving weight and cost on future military airframe structures and will allow significant increases in aircraft performance (particularly range). The amount of payoff in weight and cost to be realized will depend on the efficiency of the design concepts used. One concept proposed by AFFDL/FB has outstanding promise for a tremendous payoff, but needs development before it can be introduced into production aircraft. This program will develop essential design information on this concept, which features spar caps embedded in composite wing skins.

This effort will investigate promising new concepts for attaching spars to skins in advanced composite wing structures. An existing fighter aircraft will be used as baseline, and the new concepts will be developed to meet the specific requirements of this baseline. Activities to be conducted include preliminary design, detailed design, component fabrication, and testing of the components. A final report will be published.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, RESEARCH ON HELICOPTER ROTOR NOISE 13517-EX

H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (DA0E9139; DAAG29-78-G-0152)

To extend current knowledge of high speed helicopter rotor noise by determining the influence of non-compact source distribution on high speed rotor blade tips, the influence of aerodynamic pressure distribution on radiated near and far acoustic fields and influence of unsteady pressure fluctuations on radiated noise. Relevance - high speed rotor noise studies are very relevant to Army missions of the next few years. Blade slap must be reduced if the true advantages of nap-of-the-earth flight are to be realized. This study is also relevant to determining detectability, community annoyance and possible effects of FAR 36 on new helicopter designs.

The non-homogeneous wave equation describing the radiated acoustic pressure will be solved both analytically, where possible, and numerically in a form that removes the restrictions of compactness, hovering rotors, far-field approximation, geometry, and mathematical singularities characteristic of high tip speeds.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0012, AIRCRAFT EFFECTS ON CLIMATE

Unknown, U.S. National Science Foundation, *1800 G St. N.W., Washington, District of Columbia* 20550 (FA78WAI-911; FA161456 (TRAIS NO.))

The National Science Foundation (NSF) is to provide advisory, review and evaluation services of the climatic impact of high altitude aviation to the Federal Aviation Administration (FAA). Performing this study, the NSF shall include, but not be limited to, the following: 1) take into account the special nature of the aircraft as a perturbing source, 2) consider changes in atmospheric ozone, and 3) consider the aircraft source in the context of all other known perturbing influences.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0013, FINITE ELEMENT ANALYSIS OF TRANSONIC FLOW THROUGH A CASCADE OF AIRFOILS USING A SELF-ADAPTIVE MESH

A. Ecer, Purdue University, Graduate School, *Executive Bldg., West Lafayette, Indiana* 47907 (NSG 3294)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0014, MULTIPLE LEVEL TECHNIQUES FOR COMPUTATIONAL FLUID DYNAMICS

D.R. McCarthy, Purdue University, Graduate School, Dept. of Mathematics, *Executive Bldg., West Lafayette, Indiana* 47907 (NSG 1635)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0015, WING/BODY INTERFERENCE FLOW INVESTIGATION

J.M. Vogel, Iowa State University of Science & Technology, Graduate School, *Beardshear Hall, Ames, Iowa* 50010 (NCC 2 19)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0016, ANALYSIS OF PERFORMANCE AND HANDLING QUALITIES - CONSIDERATIONS FOR WAKE MODIFICATION DEVICES ON AGRICULTURAL AIRCRAFT

K.H. Lenzen, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Civil Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NSG 1633)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0017, A RESEARCH PROGRAM TO REDUCE INTERIOR NOISE IN GENERAL AVIATION AIRPLANES

J. Roskam, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NCC 1 6)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0018, WEIGHT ESTIMATION TECHNIQUES FOR HYPERSONIC FLIGHT VEHICLES

E.L. Cook, Wichita State University, School of Engineering, Dept. of Aeronautical Engineering, *1845 Fairmont N., Wichita, Kansas* 67208 (NCC 1 21)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0019, DEVELOPMENT OF A NICAD BATTERY INTERFACE UNIT - ARMY AIRCRAFT

C. Thomas, Chrysler Corp., Space Division, *Old Gentilly St., New Orleans, Louisiana* 70129 (DA0D4061; DAAJ02-76-C-0054)

Develop an interface between the on-board PICAD battery and the electrical system for aircraft in the field and upcoming aircraft (UTTAS, AAH) which will result in the safe, cost effective use of nickel cadmium batteries. The interface will be designed to accommodate a given battery size (11AH, 34AH, etc.) and will be common to all aircraft using that battery size.

The technical objectives of this program can best be accomplished as follows: a. Define the required/desired features in an interface unit. B. Design and fabricate or procure off-the-shelf units. C. Test to verify compliance with requirements. D. Supply prototype units for field evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0020, IMPROVEMENT OF SHORT-RANGE FORECASTS OF THUNDERSTORMS

Unknown, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, *8060 13th St., Silver Spring, Maryland* 20910 (FA78WAI-886; FA161246 (TRAIS NO.))

At the present time the FAA Air Traffic Controllers utilize only real-time information about thunderstorms and associated hazards in directing air traffic. Accurate and reliable short-range (0-2 hour) forecasts of thunderstorms, especially in the 0-30 minute time period with 10 minute updates, can aid the controller in the safe and expeditious movement of air traffic. The 0-30 minute forecast can be used in the air traffic control system 1) to expedite the movement of aircraft to avoid the hazards of thunderstorms as they move through the controlled airspace, and 2) selecting holding patterns that will minimize the effect of thunderstorms.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0021, KEVLAR PROPERTIES DETERMINATIONS

N.J. Abbott, Fabric Research Labs. Inc., *1000 Providence Hwy., Dedham, Massachusetts* 02026 (DF138070; F33615-78-C-3406)

Aerodynamic decelerators are required in the performance of many military missions such as aircraft landing decelerations, aircraft spin recovery, crew escape and recovery, weapons delivery and recovery of remotely piloted vehicles (RPVS). It is most desirable that the decelerator subsystem be as small as possible and as lightweight as practical to accomplish the objective for which it is designed. Parachute systems previously fabricated from nylon materials can be reduced in both volume and weight by as much as 50 percent by utilizing Kevlar materials. This program will determine the effects of static and dynamic loading, abrasion and cyclic loading on the properties of selected coated and uncoated Kevlar ribbon parachute material configurations and typical junctions. Reducing weight and volume of the decelerator or recovery subsystem minimizes the impact on the payload or range capabilities of the primary vehicle.

Kevlar material configurations (for which specifications have previously been developed) and typical junctions or joints in the materials will be subjected to laboratory tests to determine effects of abrasion, cyclic loading and impact loading. Where low resistance to abrasion or poor efficiency in materials is evident, efforts to effect improvements through application of coatings will be undertaken.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, COCKPIT DISPLAYS FOR NEW CONTROL CAPABILITIES

W.M. Hollister, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF142110; AFOSR-78-3620)

This work unit will support the development of cockpit displays for control configured aircraft. These advanced aircraft will provide for new dimensions in guidance and control. The addition of direct lift and side force control provides the pilot with separate control capability over all six degrees of freedom. A problem exists with using a conventional flight command system which directs attitude changes to make flight path corrections. The objective of this effort is to perform the research required to define a new display format to obtain maximum utility from the new control capabilities. Advanced combat strategies are possible with the added control dimensions, but displays must be developed to present command information required for the pilot to fly the prescribed maneuvers in current and future military aircraft.

Conduct graduate thesis research on the development of cockpit displays to provide guidance for new control capabilities. Cockpit simulation facilities will be utilized. Results will be documented in graduate thesis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, FINITE ELEMENT ANALYSIS OF CREEP AND THREE-DIMENSIONAL FRACTURE

T.H. Pian, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF048350; F49620-77-C-0084)

AF function - advanced flight vehicle structures and engine structures require improved design methods which accurately consider environmental conditions. Deficiency - accurate and efficient structural analysis methods do not exist which consider elevated temperature creep response. Objective - this research will investigate the propagation of structural defects under creep conditions. How work contributes -research will improve engine durability predictions.

This research will study the extension of hybrid finite element methods for crack analysis to include creep phenomena. Crack extension studies will investigate the stress distribution and stress time histories at the crack front. Special elements will be developed to model correct stress singularity under creep conditions. Predictions of crack growth will be compared with experimental data found in the literature. In addition six problems will be solved which involve the prediction of stress intensity factors governed by three-dimensional behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0024, VIBRATION OF COMPOSITE SHELLS WITH TRANSVERSE SHEAR

T.H. Pian, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF140450; AFOSR-77-3335)

This effort will support the design of military aircraft structures. It will improve the performance of the aircrafts and reduce the cost of the aerospace vehicles. Structural dynamics is an important facet in the design of flight vehicles. There is a need to correctly predict the vibration characteristics of advanced composite shells. This effort will develop a computer program to investigate the vibration characteristics of composite shells taking into consideration the transverse shear. The analytical results will be compared with experimental results. This will provide an improved reliable analytical tool for the design of structures leading to reliable military aircrafts.

The method of finite element analysis will be used to predict the vibration and mode shape analysis of composite shells and compare the results with the experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, FLIGHT TRAJECTORY CONTROL INVESTIGATION

M.W. Bird, Lear Siegler Inc., *4141 Eastern Ave., Grand Rapids, Michigan* 49508 (DF141380; F33615-78-C-3607)

The Air Force function for this effort is to study and develop advanced techniques for real-time flight trajectory generation and execution of complex flight paths for advanced military transport aircraft. Future mission requirements and air traffic control constraints will present significant pilot workload and performance problems to flight crews if additional capability is not provided by enhanced flight control system features. The objective of this effort is to develop a set of algorithms suitable for on-board computation of complex trajectories which also interface with pilot displays to minimize crew duties. This development will provide the Air Force capability to operate in future civil and military environments not possible with current aircraft equipments.

Development of trajectory generation software. Software validation and capability demonstration via computer-based engineering simulation. Definition of display requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, EXPERIMENTAL EVALUATION OF NON-AXISYMMETRIC EXHAUST NOZZLES

P.E. Hiley, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF136160; F33615-76-C-3019)

The relevant problem of this effort is the need to increase the range and/or decrease the fuel requirements of military aircraft plus a need for increased fighter aircraft maneuverability. The objective of this program is to experimentally investigate several non-axisymmetric exhaust nozzle concepts to determine what range improvement and/or maneuver enhancement may be obtained when the nozzles are designed into a particular airframe.

During the initial phase of the investigation selected non-axisymmetric exhaust nozzles will be designed, fabricated and statically tested to determine their relative static performance. These nozzles will then be installed in an isolated pod/wing arrangement and tested in a wind tunnel to determine their relative thrust minus drag performance and lift enhancement plus vectoring/reversal capability. The acquired data will then be used to estimate the performance (including maneuver capability) of aircraft that have the non-axisymmetric nozzles installed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, APPLICATION OF ADAPTIVE FINITE ELEMENT ANALYSIS OF INTEGRATED DESIGN AND ANALYSIS OF AIRCRAFT STRUCTURES

B.A. Szabo, Washington University, Graduate School, *Brookings 220, St. Louis, Missouri* 63130 (NSG 1640)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0028, UNSTEADY TRANSONIC AERODYNAMICS OF CASCADES

E.H. Dowell, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (NSG 3292)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0029, MULTIPLE AIRCRAFT APPROACH LANDING TECHNIQUES

A. Brockway, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Avionics Research & Development Activity, *Fort Monmouth, Red Bank, New Jersey* 07703 (DA0C3435)

The primary objective of this task is to investigate V/STOL instrument approach requirements, controller techniques, terminal area flight procedures and landing/air traffic control (ATC) equipment requirements for realizing, especially under IMC conditions, high landing rates consistent with the intrinsic flight characteristics of the helicopter. This includes an examination of V/STOL related terminal area ATM problems (via computer simulation and subsequent flight experimentation) under conditions of both IMC and VFR. The ultimate goal is to establish cooperative pilot/controller techniques and landing/ATC equipment requirements, which will make possible efficient landing of IMC terminal area V/STOL traffic with minimum separation of aircraft.

Apply AVRADA's computer simulation (I/A SIM) facility to simulate an air traffic control (ATC) terminal area with closely spaced IMC helicopter traffic. The I/A SIM facility provides for interactive input from one simulated controller position and four simulated V/STOL pilot positions. Also, investigate cooperative pilot/ATC techniques, procedures and equipment requirements allowing pilot, in cooperation with controller, to set his own separations from other nearby aircraft. Apply the data and experience from these investigations to fabricate an experimental crossbanded military microwave landing system (MMLS)/ATC system to achieve a tactical landing and ATC capability in a minimum size equipment. This system would possess the resolution, accuracy and data rate of the MMLS and would utilize the airborne MMLS receiver to solicit replies from the on-board ATCRBS transponder. These replies would be received and processed by the ground-based ATC system and presented to the controller's display with a resolution sufficient for control of closely-spaced V/STOL terminal area traffic.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

1.0030, FLIGHT EVALUATION OF THROTTLE EM FOR TRANSPORT

B. Litman, A M B A C Industries Inc., *900 Old Country Rd., Garden City, New York* 11530 (DF139730; F33615-77-C-3028)

The Air Force stands to gain substantial fuel-cost benefits through the use of fuel saving energy management flight profiles. The high costs of hydrocarbon fuels as compared with pre-1973 levels continue to impact military aircraft operations. Real-time

energy management techniques for fuel conservation have recently been analyzed for large military transport aircraft (C-141) and compared with typical flight handbook trajectories by means of digital simulation. Considerable fuel and cost savings were realized by following the optimal altitude/velocity profiles. Verification of these savings in flight through implementation and testing of fuel conserving control algorithms and system concepts is now required.

It is planned to verify potential fuel savings of transport aircraft by incorporating fuel conserving control laws in an on-board computer system with an appropriate pilot control-display interface. Fuel savings will be validated by comparing fuel optimal flights against standard flight handbook operating procedures. In addition fuel optimal flights with autothrottle and autopilot engaged will be investigated. The flight test aircraft will be the C-135C aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, AN INVESTIGATION TO IMPROVE THE PERFORMANCE OF A TECHNIQUE TO IDENTIFY LIFT, DRAG AND POWER SIMULTANEOUSLY FROM FLIGHT TEST DATA

F.O. Smetana, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Raleigh, North Carolina* 27607 (NSG 4025)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Dryden Flight Research Center

1.0032, INTERACTIVE FLOW-FIELD CALCULATIONS IN TURBOMACHINERY

E. Reshotko, Case Western Reserve University, School of Engineering, Dept. of Fluid Thermal & Aerospace, *University Cir., Cleveland, Ohio* 44106 (NCC 3 4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0033, BASIC EROSION INVESTIGATION IN SMALL TURBOMACHINERY 13653-E

W. Tabakoff, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering & Applied Mechanics, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (DA0E9138; DAAG29 76 G0229)

To investigate the erosion process of small turbomachinery in order to develop a quantitative model which will facilitate the prediction of erosion in future advanced turbomachinery in a particulate environment. Relevance - the research is relevant to the development of erosion resistant components for helicopter gas turbine engines and, to a lesser degree, to the design of efficient filtration devices for Army gas turbine-driven generator sets.

Factors affecting ductile erosion, such as angle of impingement, particle velocity, size, shape, and strength, will be investigated experimentally. Experimental and analytical work will be performed to examine the effects of target material size, velocity dependence due to the angle of impingement and the aerodynamic effect of temperature on erosion of alloys for future compressors and turbines.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0034, ENGINE/AIRFRAME/DRIVE TRAIN DYNAMIC INTERFACE DOCUMENTATION

J.R. Alwang, Boeing Co., Vertol Division, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0E3773; DAAJ02-77-C-0040)

The coupled interaction between two or more helicopter dynamic subsystems has often been the source of vibration problems. This is particularly true when considering the helicopter as a dynamic system in which excitations can be generated by any or all of the propulsion system, the airframe or the drive system. The problems of vibration-related interface compatibility in engine/drive system installations are usually complicated by the inherent coupling of the three (3) major multi-degree-of-freedom systems, i.e., engine, airframe and drive train. All background data and documentation of past experience lies in the hands of the airframe/engine industry, primarily the former. The technical objective of this contractual effort is to document industry experience to the degree required to permit plans/programs to be formulated as part of an overall government effort to accumulate data which will eventually lead to a solution of generic problems of this type.

Award sole source contracts to the major manufacturers of gas turbine powered US military helicopters, to review existing files, compile reports, memoranda, analytical design efforts, etc., and coordinate with appropriate engine manufacturers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0035, STUDY OF THE EFFECT OF TERRAIN ON HELICOPTER NOISE PROPAGATION BY ACOUSTICAL MODELING, PART I 14795-E

H. Sternfeld, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0F9145; DAAG29-78-C-0002)

To study the effect of terrain geometry on the propagation and aural detection of helicopter rotor noise. Relevance - an understanding of aural detection of helicopters is of direct concern in evaluating the U.S. Army tactics required for successful helicopter operations, especially when conducting low-level 'nap of the earth' maneuvers.

The method of acoustical modeling will be developed to understand the effects of ground terrain contours on the aural detection of helicopters, to evaluate the sensitivity of analytical predictions and/or acoustical model results to definition of ground surface and to further develop the experimental techniques for application to aural detection.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0036, INVESTIGATION OF THE CRASH IMPACT CHARACTERISTICS OF ADVANCED AIRFRAME STRUCTURES

J. Cronkhite, Bell Helicopter Co., Division of Textron, *P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3789; DAAJ02-77-C-0062)

To determine (1) the ability of advanced airframe structural materials to withstand crash impact loading, (2) the effect of these materials on impact structural integrity and impact force attenuation, and (3) technological barriers to advanced airframe structures withstanding impact loads.

Design concepts for Mil-Std-1290 airframe structures constructed from composite materials will be designed, analyzed and tested. Analytical and test results will be evaluated to ascertain structural integrity and crash impact energy absorption.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0037, CRITERIA AND CONCEPT FOR IMPROVED UH-1H MAST BUMPING SAFETY MARGIN

L.W. Dooley, Bell Helicopter Co., Division of Textron, *P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3790; DAAJ02-77-C-0064)

The purpose of the effort is to (1) develop an analytical method of predicting rotor mast loads due to hub/mast contact, (2) validate the analysis through aeroelastic model tests, (3) develop criteria for the design of the mast and a hub restraint mechanism to make contact or structural deformation improbable under typical operational conditions, and (4) develop and demonstrate the characteristics of a hub spring for the UH-1H helicopter.

An existing rotor/pylon hybrid computer analysis will be modified to predict rotor mast loads due to flapping stop contact. Aeroelastic model tests will be conducted to obtain data on mast

impact loads for subsequent program validation. Conduct a parametric study of UH-1H rotor and pylon stiffness parameters and apply toward development of mast design load criteria. Analyze, design and fabricate a nonlinear hub spring system for the UH-1H. Flight test both the baseline and modified (with hub spring) UH-1H in high flapping maneuvers to investigate hub spring characteristics.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0038, DEVELOP AND IMPROVE ANALYTICAL TECHNIQUES OF MAJOR FINITE ELEMENT PROGRAM
H. Hanson, Bell Helicopter Co., Division of Textron, *P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3845; DAAK51 78 C 0011)

To expand on the investigation of Vincent Circle technique application on a complex helicopter finite element model to include damping and dynamic absorber location changes.

Apply the Vincent Circle technique to optimize the vibratory response, at a selected point and under a specified load, on an elastic line model of AH-1G aircraft and conduct a sensitivity study using the strain energy method. Repeat the above process utilizing a complex 3-D AH-1G NASTRAN model. Also, the Vincent Circle technique will be investigated further by damping and dynamic absorber location changes.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0039, ANALYSIS OF LOW-SPEED HELICOPTER FLIGHT TEST DATA
G.A. Shockey, Bell Helicopter Co., Division of Textron Inc, *P.O. Box 482, Fort Worth, Texas* 76101 (DA0D4107; DAAJ02-77-C-0022)

To investigate the aerodynamic and dynamic behavior of a helicopter operating in the low-speed flight regime particularly in the NOE evasive mode.

Effort will consist of reducing and analyzing existing AH-1G flight test response data acquired for simulated NOE maneuvers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0040, APPLICATION OF STABILITY THEORY TO LAMINAR FLOW CONTROL
G.I. Goglia, Old Dominion University, School of Engineering, Dept. of Mechanical Engineering, *5201 Hampton Blvd., Norfolk, Virginia 23508* (NSG 1645)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0041, DESIGN OF MULTI-VARIABLE FEEDBACK CONTROL SYSTEMS VIA SPECTRAL ASSIGNMENT
S.R. Liberty, Old Dominion University, School of Engineering, Dept. of Electrical Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NSG 1650)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0042, FLYING QUALITIES OF AUGMENTED AIRCRAFT
J.M. Schuler, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF139220; F33615-78-C-3603)

This work unit supports the flying qualities specification Mil-F-8785B. The problem is to identify areas in Mil-F-8785B that can be revised to increase the safety assurance aspects of flying qualities requirements. The objectives are (1) to improve interfacing between Mil-F-8785B and the flight control system specification Mil-F-9490D, (2) development of criteria for highly augmented unstable or neutrally stable aircraft under normal and emergency conditions, (3) improve criteria concerning pilot-induced oscillations, (4) development of criteria for control saturation and pilot workload saturation conditions, and (5) development of criteria covering unusual or extreme atmospheric environmental conditions. The results will be used to make future military aircraft safer through improving the handling qualities specification Mil-F-8785B.

The approach to achieve this objective includes reviewing existing requirements and conducting analytical investigations to develop criteria for the problem ar- as identified in the objective.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, ACQUISITION AND RETENTION OF COGNITIVE VERSUS PERCEPTUALLY-ORIENTED MATERIALS
D.J. Sullivan, Canyon Research Group Inc., *32107 Lindero Canyon Rd., Suite 123, Thousands Oaks, California* 91361 (DA644249; DAHC19-77-C-0040)

To investigate the effect of various instructional strategies on acquisition and retention of aircraft ranging and engagement skills across individuals varying in academic aptitude.

To conduct a parametric investigation of the effects of instructional strategy including various mixes of principle, rule and sign learning, as a function of sex and academic aptitude on acquisition and retention of basic ranging skills. To conduct a follow-up investigation of the various mixes of perceptual and cognitive-oriented materials and strategies on acquisition and retention of ranging and rage-ring profile tasks during redeye training.

SUPPORTED BY U.S. Dept. of Defense, Research Inst. for the Behavioral & Social Sciences, Individual Training & Performance Research Lab.

3.0002, ASSESSMENT OF THE STATE OF KNOWLEDGE PERTAINING TO SOLID PARTICLE EROSION 14980-MS
W.F. Adler, Effects Technology Inc., *Santa Barbara, California* 93105 (DA0F9079; DAAG29-77-C-0039)

To carry out a comprehensive review and assessment of the field of solid particle erosion of materials and thereby elucidate the gaps in knowledge required to provide realistic information on materials response as well as information on the mechanisms underlying particle erosion processes. The review would constitute a critique of significant contributions to the subject area with sufficient supporting data to develop concepts and a useful data base. Relevance - the review relates to Army problems with particle erosion in turbines and helicopter components and may contribute new knowledge in penetrator-target interactions and in gun tube erosion.

To conduct a review of pertinent literature in the field of particle erosion, and complement the information thus gained by discussion and written communications with other researchers active in the field.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0003, PLASMA ETCHING OF THIN FILMS FOR INTEGRATED CIRCUITS
D.W. Hess, University of California, Berkeley Campus, School of Engineering, Dept. of Chemical Engineering, *Berkeley, California* 94720 (ENG7812236)

This program is providing a systematic investigation of basic factors that influence etching of films of such materials as silicon nitride, silicon dioxide, poly-crystalline silicon, and aluminum, all of which are important to the fabrication of integrated circuits. Variables being considered include etching gas, radio-frequency power levels, gas pressure, gas dynamics, substrate temperature, and electrode spacing. Characterization of the various etching procedures includes the development of kinetic models that lead

to increased quantitative understanding of the plasma processes. These models are likely to result in improved processing methods and thus higher performance and lower cost integrated circuits.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

3.0004, LABORATORY MEASUREMENTS OF REACTION RATE OF HYDROXYL RADICALS (OH) WITH CHLORINE MONOXIDE (ClO)

Unknown, Xonics Inc., *6911 Hayvenhurst Ave., Van Nuys, California* 91406 (FA78WA-4262; FA161587 (TRAIS NO.))

The purpose of this effort is to measure by direct observation of reactants and/or products over the relevant range of stratospheric pressure and temperature, the absolute rate of coefficient and products for the reaction of the hydroxyl radical (OH) with chlorine monoxide (ClO). The rate coefficient for the reaction will be measured over a temperature range of 200K to 300K using a variable reaction length, flow system, or for slow reactors, a stopped flow, stirred reactor system. Absolute measurements of (O), (Cl), and (OH) will be made by resonance scattering methods, and (ClO) shall be measured by chemical conversion to Cl and measurement of (Cl).

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

3.0005, NEW CHEMICAL ANALYSIS TECHNIQUES

R.E. Sievers, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Chemistry, *1200 University Ave., Boulder, Colorado* 80302 (DF042170; F44620-76-C-0031)

AF function - advanced analytical and experimental techniques are needed to support the Air Force mission in the sensing and detection areas. Deficiency - this area of research has need of measurement techniques that are highly sensitive and selective. Objective - the program deals with several distinct and interrelated measurement techniques which include chromatographic separation and mass spectrometric analysis of isotopes, metal complexes that are highly soluble in organic solvents, nuclear magnetic resonance of metal chelates, thermal gravimetric analysis, environmental analytical chemistry, and trace analysis. How work contributes - volatile metal chelates will be exploited to develop more rapid separation and accurate analytical methods in order to determine very low but significant concentrations of metals and their compounds, that play a part in engine wear and pollution problems.

In materials technology there is a continuing need for fluids that will withstand high temperatures without thermal, hydrolytic or oxidative breakdown. A synthesis and materials characterization study will be carried out on new metal chelates that are potential candidates as high temperature fluids. A system is being developed, capable of analyzing small concentrations of nitrogen oxides, hydrocarbons, and various trace metals, using gas chromatography coupled with a microwave excited emission detector. This method of detection is inherently selective in its mode of action, highly sensitive, and applicable to quantitative and qualitative analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0006, ANALYSIS AND DESIGN OF COMPOSITE BONDED JOINTS UNDER A DYNAMIC TYPE LOAD

J.R. Vinson, University of Delaware, School of Engineering, Dept. of Mechanics & Aerospace Engineering, *Newark, Delaware* 19711 (DF027060; AFOSR-74-2739)

AF function - advanced aerospace vehicle designs require improved structural efficiency to meet mission objectives and improved durability to reduce Air Force ownership costs. Opportunity - advanced composite materials for primary structure and adhesive bonding represent significant new opportunities to enhance Air Force structures in functions indicated above. Objective - the objective of this research is to experimentally study the fatigue behavior of composite adhesively bonded joints and identify the failure mechanisms and governing parameters. How work contributes - this research contributes to the technology base associated with composite structural development for aerospace vehicles.

Approach being followed by this research is experimental primarily. Single lap joints of graphite epoxy will be statically and fatigue tested. Tests will include environmental exposure to both moisture and temperature in order to study degradation of both composite adherends and adhesive. In particular, changes in failure mechanisms which can occur as a result of environment will be sought. Load-frequency effects will also be studied through experimentation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0007, THE INFLUENCE OF THERMAL-MECHANICAL TREATMENTS ON THE FRACTURE OF POLYMERS 12710

L.J. Broutman, Illinois Inst. of Technology, School of Engineering & Physical Science, Dept. of Metallurgical & Materials Engineering, *3300 S. Federal St., Chicago, Illinois* 60616 (DA0N5570; *DAAG29 77 G0160*)

To conduct a quantitative study of the effects of residual stresses upon toughness and fracture behavior of glassy amorphous polymers such as polycarbonates and polymethylmethacrylate. The role of residual stresses in stress cracking will also be addressed. Relevance - the proposed research is relevant to Army problems in transparent armor (for aircraft and personnel protection) and in the processing of many hardware components molded of glassy polymers.

Residual stresses will be introduced into polymer sheets by thermal quenching and/or mechanical deformation. The three-dimensional stress states will be measured by ultrasonic wave techniques. The latter, together with optical birefringence studies and stress analysis methods, will be employed to distinguish between elastic locked-in stresses and the residual molecular orientation due to flow of the polymers. The effects of the various residual stress states on the physical properties of the polymers will be determined, with consideration to stress relaxation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0008, DEVELOPMENT OF THE THEORY OF REFLECTANCE AND EMITTANCE OF FIBROUS MATERIALS 14076

J.R. Aronson, Arthur D. Little Inc., *15 Acorn Park, Cambridge, Massachusetts* 02140 (DA0F8932; DAAG29 77 C 0011)

To develop the theory of reflectance or emittance of particulate materials so as to apply it to fibrous materials. Relevance - the research is relevant to the Army's interest in the areas of laser hardening, camouflage, and thermal insulation.

Specifically, research efforts will be concerned with obtaining the optical constants of model materials, constructing a theoretical model of the reflectance or emittance of fibers and making experimental measurements of the infrared emittance to verify and modify the developing theory.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0009, VISCOUS FLOW AND CRYSTALLIZATION BEHAVIOR OF HYDROCARBON MIXTURES

D.R. Uhlmann, Massachusetts Inst. of Technology, School of Engineering, Dept. of Metallurgy & Materials Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 3286)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0010, MICROSTRUCTURE OF AMORPHOUS AND SEMI-CRYSTALLINE POLYMERS

D.R. Uhlmann, Massachusetts Inst. of Technology, School of Engineering, Dept. of Metallurgical & Materials Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF046980; AFOSR-77-3226)

AF function - advanced aircraft systems will utilize lightweight polymeric and adhesively bonded structural components and composites and impact resistant transparent canopy materials. Deficiency - although the mechanical and optical properties are determined by processing, the fundamental understanding governing behavior is inadequate. Objective -selected microstructural features of amorphous and semi-crystalline polymers and their relation to processing and mechanical, physical and optical properties will be investigated. How work contributes - this research will help develop the understanding regarding the character of supramolecular structure and the importance of specific morphological features in determining properties which is needed for processing matrix and adhesive resins whose chemistry and microstructure can reproducibly be tailored to specific needs.

The study will explore (1) nodular structures in amorphous thermosetting and thermoplastic polymers (2) chemical and structural differences between bulk material and near-surface regions in semi-crystalline polymers (3) crystallization behavior under high thermal gradients and its effect on structure and (4) differentiation between adjacent re-entry folding and switchboard models for the basic structural units in semi-crystalline polymers. In each case a combination of experimental techniques will be used to elucidate the important structural features of the materials and their variations with changes in process conditions. The structural features will in turn be related to the mechanical and optical properties of the materials with specific attention directed to yield and fracture behavior and to transparency at optical frequencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0011, ORGANOSILICON COMPOUNDS AND ORGANOSILICON POLYMER INTERMEDIATES

D. Seyferth, Massachusetts Inst. of Technology, School of Science, Dept. of Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF041490; AFOSR-76-2917)

AF function - future Air Force flight operations require better environmental resistant materials. Deficiency - fluids and lubricants are needed as hydraulic fluids, coolants, engine oils and gyro fluids. Seals and sealants serve indispensable needs for fuel, liquid and air retention, and expulsion bladders in liquid rocket systems. Objective -a study of the synthesis and properties of new organosilicon compounds which may prove useful for these purposes. How work contributes - the work will provide new compounds and new methods of synthesizing organosilicon and related compounds.

The research will involve a study of the chemistry of silacyclopropanes, including ring opening reactions and dimethylsilylene extrusion, the chemistry of silacyclopropenes, and the Diels-Alder route to arylene-bridged disilanes suitable for organosilicon polymer preparation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0012, EFFECT OF STRUCTURE ON PHYSICAL POLYMER INTERACTIONS AND PROPERTIES

F.E. Karasz, University of Massachusetts, Amherst Campus, School of Engineering, Dept. of Polymer Sciences & Engineering, *Amherst, Massachusetts* 01002 (DF043340; AFOSR-76-2983)

AF function - advanced aircraft employ structural materials which require superior performance characteristics over a broad range of temperature and environmental conditions. Deficiency - new high-temperature polymer systems are difficult to process and the effects of processibility on properties and life expectancy for these systems are not understood. Objective - this research is to study how molecular structure and morphology on a supermolecular scale govern polymeric interactions and the resultant physical and mechanical properties. How work contributes - it is expected that this research will generate information for the processing of intractable, high temperature resin systems and self-reinforced or molecular polymeric composites and the design of mechanisms to overcome the polymeric degradation due to temperature-humidity effects.

Polymer physical chemistry will center on (1) development of the specific principles for predicting compatibility and alloying in multi-component polymer systems, (2) assessment of the interaction of water with epoxies to include determination of the kinetics and equilibrium properties of the interactions and analyses in terms of a bound-water model, and (3) characterization of the conformational states of rigid chain polymers using polybenzoximidazole as a model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0013, EUTECTOID DECOMPOSITION IN TITANIUM ALLOYS

H.I. Aaronson, Michigan Technological University, School of Engineering, Dept. of Metallurgical Engineering, *Houghton, Michigan* 49931 (DF038240; AFOSR-74-2595)

AF function - a rational basis for materials development is required to assure the availability and effective utilization of structural materials in future Air Force systems. Opportunity - the fundamental methodology to provide comprehensive and systematic improvement of existing metallic materials and creation of new materials is dependent upon an understanding of the physical metallurgy of alloys. Objective - this investigation will deduce the principles underlying the eutectoid decomposition processes in titanium alloys. How work contributes - understanding of these phase transformations is necessary in order to furnish a more substantial base for the development of useful titanium alloys in which these processes play an important role in determining their microstructure and mechanical properties at room and moderately elevated temperatures.

Specifically, this research will determine why the massive transformation of beta to fully supersaturated alpha occurs in some Ti-X eutectoid systems but not in others, and the ability of the bainite reaction to compete with pearlite formation in hypo-eutectoid and eutectoid alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0014, BERLINITE CRYSTAL GROWTH

R.F. Belt, Litton Precision Products Inc., *200 E. Hanover Ave., Morris Plains, New Jersey* 07950 (DF903140; F19628-77-C-0213)

Air Force function - navigation, communication, surveillance. Deficiency - presently available resonator materials cause long term frequency drifting. Objective - to develop superior material for both timing and acoustic surface wave devices. How research contributes -development of new possibly superior material may result in improved timing and acoustic surface wave devices.

The approach will be the study and growth of berlinite (aluminum phosphate) of sufficient size and quality for evaluation as timing and acoustic surface wave material. The hydrothermal crystal growth technique will be used.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0015, RESEARCH ON UNSTEADY COMBUSTION PROCESSES

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AF function - most advanced Air Force strategic and tactical rocket weapons rely on solid propellants for propulsion. Deficiency - more energetic and reliable propellants are required for future weapons. Objective - this research is aimed at increasing the understanding of the unsteady combustion process which occurs in solid propellants, especially in the areas of velocity coupled instabilities and the burning of aluminum droplets. How work contributes - the understanding gained will permit the design of more reliable high performance missiles.

Three directions of study are being pursued simultaneously in this broad investigation of solid propellant combustion. The first is a combined analytical and experimental effort centered

around the modulated throat rocket motor (MTRM), which is a system for gathering meaningful data over a wide range of realistic operating conditions of actual small motors. The dynamic responses of the combustion process to external excitation of longitudinal pressure and velocity waves are measured as functions of frequency, mean pressure, propellant characteristics, internal Mach number and propellant geometry. The second research topic is elucidation, primarily through high-speed photography, of the agglomeration and combustion processes for aluminum particles in propellants. Size, purity and pretreatment of aluminum particles, as well as chamber pressure and cross-flow velocity are variables. In the third portion of the effort, break-up of aluminum and alumina agglomerates in the accelerating flowfield associated with entering or approaching the rocket nozzle will be examined both experimentally and analytically.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0016, FUELS COMBUSTION RESEARCH

I. Glassman, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (DF001830; F49620-78-C-0004)

AF function - weapons delivery, air support, airlift. Deficiency -accurate modelling of combustion and exhaust plume processes in present and future aircraft engines requires much more reliable numerical values of molecular reaction rates than are presently available. Objective -as an AFOSR center for fuels combustion research, this group will perform research leading to understanding of kinetic mechanisms and to accurate values of reaction rate constants for pyrolysis and oxidation of hydrocarbon constituents of present and alternative fuels. How work contributes - the results of these experiments are directly useful to design engineers in jet combustion and plume technology and also to scientists working on the elusive problems of combustion dynamics.

High-temperature homogeneous gas-phase reaction kinetics of hydrocarbon fuel constituents are being studied in flow reactors. The extensive concentration and temperature data obtained as functions of reaction time are used to obtain the correct kinetic mechanisms and global rates and rate constants. Spectroscopic and mass spectroscope capabilities are being added to obtain rate constants of reaction steps involving free radicals and many large product species. The mechanisms of soot formation and of carbon oxidation are also to be studied in experiments yet to be devised. A theoretical effort will be devoted to development of an efficient and comprehensive kinetic sensitivity analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, VAPORIZATION AND COMBUSTION OF MULTICOMPONENT FUEL DROPLETS

W.A. Sirignano, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Sciences, *Box 430, Princeton, New Jersey* 08540 (ENG7812564)

The research deals with an experimental and theoretical investigation of the vaporization and burning of liquid fuel droplets which contain more than one chemical component. The objective is the prediction of the transient rate of vaporization of individual components from multicomponent liquid fuel droplets during vaporization and burning in convective flow. The predictions are compared with experimental measurements. Two-component fuel droplets of small size are collected from a high velocity, high temperature laminar gas flow. Fuel components of relatively low boiling temperature are used to preclude droplet pyrolysis. A new phase-discriminating droplet collection probe is used. The efficiency of the probe is being inve tigated. The chemical composition of collected droplets are determined with a gas chromatograph. The research provides a model of droplet burning. The model is related to combustion in diesel engines, gas turbines and furnaces.

The research is a continuation of work done under NSF Grant ENG7681253.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

3.0018, HYDROGEN AND FATIGUE PROPERTIES OF STEEL

H.H. Johnson, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science & Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (NSG 2399)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0019, STRESS INDUCED HYDROGEN CONCENTRATION CHANGES IN TITANIUM PHASE III

P.N. Adler, Grumman Corp., Grumman Aerospace Corp, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF043350; F44620-76-C-0071)

AF function - hydrogen embrittlement is a serious problem that causes mechanical property degradation in our most significant aircraft materials including steels, titanium, aluminum and nickel-base alloys. Hydrogen related phenomena are suspect of playing key roles in the mechanisms of stress corrosion cracking, subcritical crack growth, hot salt corrosion, weld cracking, temper embrittlement, fatigue crack growth, and brittle fracture in general. Opportunity - stress induced hydrogen concentration changes appear to be basic to this problem. Objective - this research will determine the extent and kinetics of the hydrogen redistribution that takes place in titanium alloys under the influence of elastic and plastic deformation. How work contributes - the various forms of hydrogen-related mechanical property degradation severely restrict the serviceability of our important aircraft materials. Basic understanding of the manner by which hydrogen acts to reduce mechanical strength and cause failures is important if we are to minimize and control these forms of attack.

Objective will be accomplished using Grumman's recently developed lithium nuclear microprobe (LNM) technique that enables in situ hydrogen concentration measurement in the surface of samples while under an applied stress. The results of these measurements will permit evaluation of the manner by which hydrogen participates in crack propagation and embrittlement.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0020, ION BEAM TEXTURING OF POLYMERS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0021, SELF-DIFFUSION OF OXYGEN AND ALUMINUM IN DOPED ALUMINA

A.R. Cooper, Case Western Reserve University, School of Engineering, Dept. of Metallurgy & Materials Science, *University Cir., Cleveland, Ohio* 44106 (NSG 3291)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0022, INFLUENCE OF COMPOSITION AND MICROSTRUCTURE ON THE LOW-CYCLE FATIGUE RESISTANCE OF A-PHASE AND NEAR A-PHASE ALLOYS

J.C. Williams, Carnegie Mellon University, Inst. of Technology, Dept. of Metallurgy & Materials Science, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF042420; AFOSR-76-2925)

AF function - titanium and its alloys have been of considerable interest to the Air Force because of very favorable strength-to-weight characteristics at temperatures from cryogenic up to 800 degrees F, and resistance to attack by many chemicals. Potential applications for skins, structural and engine components of high performance aircraft, cryogenic fuel storage tanks for missiles, and tubing for transporting corrosive fuels all emphasize the available materials roles for titanium alloys. Opportunity - the occurrence of strain localization due to the development of localized regions which are plastically unstable results in severe reductions in fatigue and ductility of many high strength structural materials including certain titanium alloys.

Thus, the critical strain for fracture can be locally surpassed at very low average macroscopic strains, since such instabilities can lead to premature failure. Objective - this research will provide an improved understanding of the metallurgical factors which control strain localization, and the relationship of strain localization phenomena to low-cycle fatigue performance of alpha-Ti alloys. How work contributes -the use of alloys which exhibit the tendency for strain localization requires particular caution since the tolerance for local stress concentrations is reduced.

The program consists of two interrelated tasks: (1) the role of alloy composition in controlling deformation behavior and the relationship between deformation behavior and low-cycle fatigue performance, and (2) the role of microstructure on deformation behavior and low-cycle fatigue performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0023, DIRECTIONAL SOLIDIFICATION OF NONOXIDE EUTECTICS 14069-MS

V.S. Stubican, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Materials Science, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (DA0E9298; DAAG29 77 G0057)

Study the directional solidification of several refractory carbide and boride compositional systems which exhibit eutectics, and relate the resulting microstructures to selected mechanical properties of the materials. Relevance - the materials to be studied may find use as high temperature unlubricated bearings for helicopters, as ceramic tool bits, as high temperature ceramic turbines and adiabatic diesel engines for Army vehicles, and as high temperature missile components.

Determine the crystallography of the eutectic systems and elucidate the fundamental factors which determine the topotaxial relations, measure the three and four point bend strength of the specimens as a function of temperature up to 2000 C, and evaluate the microhardness and wear resistance of the specimens.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0024, PROPERTIES OF MATERIALS FOR ADVANCED ENERGY SYSTEMS

M.M. Abraham, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (AK-01-02-02-2; W7405-ENG-26)

This program consists of three major tasks concerned with the determination of fundamental information on the properties of materials that will be needed to develop new technologies for the production, storage, and transport of energy. Research on the physical properties of ceramic materials is directed toward obtaining a better correlation between the desirable macroscopic behavior of ceramics and their microscopic properties. Investigations on the physical properties of superconductors are concerned with methods for obtaining higher critical current densities and higher transition temperatures. The program on the research and development of pure materials involves the determination of new techniques for the purification, crystal growth and characterization of research quality materials that are needed in the research and development programs sponsored by DOE. (ORNL/CF-78/111)

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SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, DYNAMIC RESPONSE OF SOLID ROCKET MOTORS TO TRANSVERSE BLAST LOADS

T.L. Cost, Athena Engineering Co., *P.O. Box 235, Northport, Alabama* 35476 (DA0N4518; DAAD05-76-C-0751)

The objective of this effort is to develop the theory and computer program required to predict the structural response of a solid rocket motor subjected to transverse air blast loads while simultaneously subjected to internal pressure and transverse acceleration loads.

The approach to the problem will be primarily theoretical and will involve the development of a structural analysis method which can be implemented on a digital computer.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0002, LASER MISSILE GUIDANCE CONCEPT (ROCKET DESIGN)

R.W. Forgey, U.S. Dept. of Defense, Army, Missile Research & Development Command, Engineering Lab., *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0E1287)

Define flight vehicle for Growlar Program.

Select a suitable test vehicle for the demonstration program, from all available candidates, and initiate design effort to produce drawings from which the test hardware may be manufactured.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Technology Lab.

4.0003, THIN FILM OPTICAL DEVICES AND QUANTUM ELECTRONICS

A. Yariv, California Inst. of Technology, Graduate School, Dept. of Engineering & Applied Science, *1201 E. California Blvd., Pasadena, California* 91109 (DF041480; AFOSR-78-3685)

AF function - the Air Force seeks decreased distortion in fiber optic transmission for avionic system miniaturization, cost reduction, and bandwidth extension and novel tunable lasers especially solid state for optical communication and electronic warfare including jamming. Opportunity - exploration of novel pioneering concepts for devices for optical communication and electronic warfare. Objective - to investigate 1) direct transmission of optical information through optical fibers of kilometer lengths, 2) interaction of electron beams with longitudinal EM waves in a periodic structure environment, 3) Raman scattering in optical fibers experimentally and theoretically. How work contributes -success in objectives will lead to devices useful for optical communication and electronic warfare systems.

1) Compensate for distortion in transmission of optical information in optical fibers through introduction of phase conjugation by means of four wave-mixing, 2) attenuate velocity spread of electrons as electrons propagate in periodic structure and interact with longitudinal EM wave by cascading periodic structures with compensatory entry phases, 3) compare experiment with theory of optical fiber Raman laser and construct this laser including tuning by Franz-Keldysh effect.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, ADVANCED MISSILE AERO CONTROL INVESTIGATION

M.D. Thomas, Lgarde Inc., *1555 Plancentia Ave., Newport Beach, California* 94304 (DA0G1033; DAAK40 78 C 0072)

The objective of this effort is to investigate the adaptation of a movable aerodynamic flare to present and advanced missile systems in order to compare increases in control effectiveness and maneuverability characteristics.

A conceptual design of the advanced aerodynamic control, adapted to existing Pershing II and Patriot missile systems, shall be accomplished to provide baseline configurations from which performance calculations can be made to determine increases in

maneuverability and a reduction in control system weight thus providing a lower systems cost. An open-loop 6 DOF simulation shall be performed to ascertain the performance when comparisons are made between the baseline configurations and the existing Pershing and Patriot missiles. A plan for a flight demonstration program to include recommendations as to possible flight test boosters as well as test ranges, costs and other related parameters shall be developed and submitted as part of the final report.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Technology Lab.

4.0005, SINGLE CHIP CCD LENSES FOR ULTRASONIC IMAGING

J.D. Meindl, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DF050130; F49620-77-C-0133)

AF function - the maintenance and quality assurance of flight vehicles relies heavily on nondestructive evaluation (NDE) of critical metallic components. Deficiency - there is a deficiency in techniques to specify size, shape and orientation of flaws which initiate catastrophic failure. Objective - the objective of this research is to develop electronic focusing of acoustic field patterns detected by piezoelectric transducer arrays. How work contributes - the monolithic electronic lenses would serve to reduce present ultrasonic imaging system weight, volume, power consumption and cost as much as an order of magnitude. In addition, they would permit improvements in system resolution, field of view, range and frame rate heretofore unfeasible.

Cascade charge coupled device (C3D) integrated circuit analog delay lines will be explored for ultrasonic imaging systems. Various models will be developed to characterize the influence of device technology on lens performance. Theoretical analysis and fabrication methodology will be adjusted to optimize performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, SUPERCONDUCTING WEAK LINKS FOR MIXING AT MILLIMETER-WAVE FREQUENCIES 13678-EL

T.V. Duzer, University of California, Berkeley Campus, Graduate School, *2200 University Ave., Berkeley, California* 94720 (DA0E9086; DAAG29 76 G0191)

To study novel schemes for detection and mixing in the millimeter and submillimeter wave range. This work will have a long range impact on millimeter and submillimeter wave programs in the Army such as the beam rider guidance system, or general radar and terminal homing applications.

To investigate Josephson junctions for low noise mixing and detection in waveguide applications (below 150 gHz), test wave impedance matching arrays for submillimeter wavelengths, and continue comparison between Josephson junctions and super-Schottky metal-insulator metal characteristics.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0007, BASIC RESEARCH IN ELECTRONICS (JSEP)

D.J. Angelakos, University of California, Berkeley Campus, School of Engineering, Dept. of Electrical Engineering & Computer Science, *Berkeley, California* 94720 (DF008700; F44620-76-C-0100)

AF function - electronic research is essential to all Air Force missions and functions, especially aerospace reconnaissance, communications, surveillance, navigation, command and control of operating forces, and gathering, processing, and transmission of intelligence and information. Technology for all of these functions requires more compact, lower power consumption, higher sensitivity and more reliable electronic components, networks and systems. Opportunity - this technology is dependent on continued research on properties of electronic materials, circuits, and systems. Objective - the joint services electronics program (JSEP) provides the research baseline in the electronic sciences for all three military services. How work contributes - jointly and equally supported and managed by the Air Force, Army and Navy, this program provides the DOD with a hard core electronic research capability which includes a highly flexible, quick response to new research opportunities over a broad area of electronic science and engineering.

One part of the electronic research being conducted concerns solid-state electronics, and electro-magnetics. These areas entail fundamental theoretical and experimental studies of semiconductor devices, semiconductor properties and technologies, studies in select areas of electromagnetic wave guiding scattering and measurement techniques. This portion of the JSEP deals with research in large scale system theory, circuit analysis and synthesis, VLSI circuits, signal processing, and data base management systems. Specifically, new emphasis is being placed on problems arrising in data base systems distributed over many host computer systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, LASER-INDUCED FLUORESCENCE SPECTROSCOPY FOR MAKING IN-SITU SPECIES CONCENTRATION MEASUREMENTS IN TURBULENT COMBUSTION FLOWS

J.W. Daily, University of California, Berkeley Campus, School of Engineering, Dept. of Mechanical Engineering, *Berkeley, California* 94720 (DF049060; AFOSR-77-3357)

AF function - advanced diagnostic techniques, advanced air-breathing engines, weapon delivery and defense. Deficiency - inability to obtain reliable measurement of important parameters in turbulent reacting flows in practical hostile combustion environment via present day measuring and diagnostic techniques, inability to reliably evaluate combustion models. Objective - to develop sensitive selective, precise, reliable and rapid diagnostic methods for measuring important parameters in jet engine reacting flow environment. To determine feasibility of using laser induced fluorescence spectroscopy (LIFS) for obtaining high spacial and time resolution in-situ species concentration measurements in practical combustion environments, to determine capabilities and limitations of LIFS as a laboratory diagnostic tool, to provide reliable experimental data to the combustion modeler. How work contributes - will provide additional understanding and reliable data to permit realistic evaluation of analytical models of complex reacting flows, will help reduce development time and cost of air-breathing propulsion systems, will permit evaluation of capabilities and limitations of various diagnostic methods, will aid in development of improved or novel new in-situ nondisturbing techniques for accurately measuring turbulent reacting flow parameters.

Using laser-induced fluorescence spectroscopy techniques, measurements will be made of hydroxyl radical concentrations in two laboratory burners, one laminar and one turbulent. Standard burners will be used wherever possible. Initial work will involve examination of the OH spectrum in both flames, mapping interferences, temperatures, and concentrations using conventional absorption and emission spectroscopy. The OH fluorescence spectrum will then be measured in the laminar flame and saturation and trapping effects examined. Results will be used to optimize the excitation and detection schemes. Data acquisition electronics and signal processing will be developed. The system will be applied to the turbulent flame and fluorescence results compared with those from more conventional measuring techniques. The experimental procedures will be guided by and the results compared with a theoretical model that will be developed to describe the excited state populations of OH. Additionally, theoretical predictions of turbulence results will be made using standard theory for comparison with experimental results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, TURBULENCE MEASUREMENTS BY RAYLEIGH SCATTERING

L. Talbot, University of California, Berkeley Campus, School of Engineering, Dept. of Mechanical Engineering, *Berkeley, California* 94720 (DF038830; F44620-76-C-0083)

AF function - aerospace vehicles, air-breathing propulsion, weaponry. Deficiency/opportunity - experimental study of turbulent flows associated with aerospace vehicles and their propulsion systems has been hampered in the past by the lack of non-intrusive measurement methods suitable for measuring all the desired quantities. Hot wires have produced much important information, but they do disturb the flow, and they cannot survive many of the harsher environments in which it is desired to make measurements. The laser Doppler velocimeter (LDV) techniques promise a new dimension in turbulence measurements, but these can measure flow velocity only. Knowledge of turbulent fluctuations of temperature, gas composition, and gas density, as well as pressure and velocity, would contribute to the body of known information about turbulence and diminish the amount of speculative assumption that goes into scientific and engineering work with turbulent flows. The proposed work explores the recent innovation in gas velocity and temperature measurement by Rayleigh scattering, combining it with LDV or hot wire methods, to obtain data on both the temperature and velocity turbulence in hostile gas flow environments. Objective - to provide a practical demonstration of the use of Rayleigh scattered laser light for investigating turbulent flows in a severe environment, and at the same time to gain knowledge of the interaction of turbulence with exothermic reactions or other heat releasing processes in gas flows. How work contributes - many modern applications of gas dynamics involve flows in which chemical reactions occur. It is well known that turbulence in a flow can be amplified by an exothermic chemical reaction. A quantitative correlation between these phenomena could serve to clear up some troublesome questions about entropy layers, flame zones, and radiating or absorbing flows.

Extensive demonstration of the Rayleigh scattering diagnostic method, in combination with LDV will be made in experiments. Interaction of a Karman vortex street with a plane laminar flame, interaction of flat plate boundary layer turbulence with a standing flame, and survey of the flow field near a curved standing flame will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, CONDUCTIVITY IN MODIFIED GRAPHITE
Unknown, University of California, Davis Campus, Graduate School, *Davis, California* 95616 (NAS 2-10258)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0011, WAVES AND INSTABILITIES IN STEADY-STATE HIGH-BETA PLASMAS
N.C. Luhmann, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Electrical Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (DF035050; F49620-76-C-0012)

AF function - operation of high-altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of high-beta processes occurring in plasmas such as waves and instabilities caused by beams of particles and photons. Deficiency - the aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by a well planned theoretical and experimental research. Objective - this project will investigate both theoretically and experimentally the behavior of high-beta plasmas specifically studying their waves and instabilities, their interaction with electron and laser beams as well as the abnormally high appearing resistivities. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

This project will perform theoretical and experimental work to specifically study the following - A. Interaction of the electromagnetic radiation with an inhomogeneous near critical density plasma, namely, 1. Resonance absorption, 2. Density profile modification, 3. Parametric instabilities, 4. Nonthermal hot electron production, 5. Main body heating, 6. Magnetic field generation, 7. second harmonic generation. B. Instabilities in an underdense plasma, including both the absorptive instability occurring at the quarter critical layer (two plasmon decay) and the reflective instabilities, namely, 1. Stimulated Brillouin scattering and 2. Stimulated Raman scattering. C. Self focussing instabilities, which occur when intense microwave or laser beams are propagated through plasmas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, MAGNETIC FIELD INTERACTIONS WITH MATERIAL DISCONTINUITIES 13279-MS
W. Lord, Colorado State University, School of Engineering, Dept. of Electrical Engineering, *Fort Collins, Colorado* 80523 (DA0E9194; DAAG29 76 G0249)

To model the interaction of magnetic fields with material discontinuities using finite element analysis techniques. Relevance -the research is relevant to nondestructive evaluation of steels used in such components as gun tubes, munitions, pipe, aircraft etc. To detect inclusions voids and cracks. It is also relevant to the design of magnetic ordinance and communication devices where geometry and spatial distribution of magnetic fields are important. The computer codes to be generated as a result of the research will be made available to Army scientists, and this is relevant to processing of data in various R and D programs in Army laboratories.

The program will include development of magnetic leakage field profiles for a variety of surface and subsurface defects in an axially magnnetized ferromagnetic bar; measurement of magnetic leakage fields around actual defects using hall plates, and comparison of results with theory; and extension of models to include residual forms of magnetization and study of the feasibility of using finite element analysis to model eddy current interactions with material discontinuities.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0013, DEVELOP A NAVIER-STOKES ANALYSIS FOR THE AFT-END FLOW FIELD OF AERODYNAMIC VEHICLES 15905-E
H. McDonald, Scientific Research Associates Inc., *Glastonbury, Connecticut* 06033 (DA0G8961; DAAG29-79-C-0003)

To develop a Navier-Stokes solution for the viscous elliptic portion of jet plume interaction flow fields in the vicinity of an axisymmetric base. Relevance - the research is directly relevant to the improved design of Army missiles, rockets and projectiles.

A local flow field Navier-Stokes analysis including flow both upstream of the base where a shock wave-boundary layer interaction may occur on a boat-tail and downstream of the base where recirculation may be present will be carried out. This detailed solution then would be joined either to inviscid solutions or viscous parabolic solutions in an interactive manner to determine the entire flow field.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0014, STRUCTURE OF AUTOMATIC CONTROL SYSTEMS
A.S. Morse, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (DF046570; AFOSR-77-3176)

AF function - the design of aerospace and turbojet control systems. Deficiency - the control process is still poorly understood for nonlinear and time-varying systems. Objective - the objective of this research program is to develop concrete analysis and synthesis methods for dealing with the engineering problems encountered in the design of complex control and information systems. How work contributes - this work would provide new aspects from which to analyze the control design problem.

Research will be made in a number of important design problems associated with the identification and control of linear multivariable systems. Included will be the continuation of a fundamental study of self-tuning systems with the objective of developing effective techniques for designing such systems so that they function reliably over a reasonable range of process operating conditions - the study is motivated, in part, by the control requirements of proposed, high performance turbojet engines. A study will be made of the basic properties of nonlinear dynamical systems with input-output maps admitting finite Volterra series expansions. An effort will be made to develop systematic procedures for constructing realizations directly from multivariable transfer function data and for designing practical feedback controllers for such systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0015, PROBING OF TRANSONIC BOUNDARY LAYERS 15172-E

J.E. Danberg, University of Delaware, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Newark, Delaware* 19711 (DA0F9168; DAAG29-78-G-0057)

To probe the boundary layer on spinning and non-spinning projectiles with the aim of developing physical insight into the reasons for the observed strong variations in pitching moment and magnus force and moments at transonic speeds. Relevance - the proposed investigation is directed toward obtaining a physical understanding of large pitching moment variations observed at transonic speeds on several of the Army's projectiles being evaluated by BRL. Consequently, the research is directly relevant to performance prediction and development of stable long range gun-launched projectiles.

Pilot probing of the flow field will be one of the main techniques used to obtain new information on the state of the boundary layer on the projectile afterbody. The measurement technique will be verified for certain flow conditions and will then be applied to realistic boat-tails.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0016, EIGENVALUE/EIGENVECTOR ASSIGNMENT IN LINEAR SYSTEMS

A.K. Choudhury, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 7624)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

4.0017, NOISE SUPPRESSION IN JET INLETS

B.T. Zinn, Georgia Inst. of Technology, School of Engineering, Dept. of Aerospace Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF047490; F49620-77-C-0066)

AF function - improved aerospace vehicles. Opportunity - reduce noise levels produced by air-breathing engine-inlet configurations. Objective - develop and experimentally verify an analytical technique for predicting the far field radiated noise taking variable noise source characteristics, duct absorption properties and inlet geometries into consideration. How work contributes - a better understanding of the coupling mechanisms of the noise generated in the engine inlet ducting (fans and compressor noise) with the far field radiated noise is required. Also, methods for evaluating the effects of various duct wall acoustic treatments and engine-inlet configurations are needed. Full success of this effort will allow the accurate prediction of the far field noise levels of an engine-inlet and changes to this level due to inlet duct treatment or inlet geometry without the costly cut and dry full-scale testing required at present.

An integral formulation of the Hemholtz equation will be developed, discretized and solved numerically. This formulation will couple the sound source with the radiated far field and will account for changes in the far field due to inlet geometry and wall acoustic liner treatments. Experimental data will be obtained of the radiated sound field from several simple inlet configurations to evaluate the theoretical predictions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, INTERNAL AND EXTERNAL BALLISTICS OF MISSILES WITH SPECIAL CONSIDERATION OF JET PLUMES INTERFERENCE EFFECTS DURING LAUNCH AND FREE FLIGHT PH

H.H. Korst, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mechanical & Industrial Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DA0E9089; DAAG29 76 G0209)

To conduct a comprehensive research program dealing with aerodynamic interference problems encountered during various phases of in-tube propulsive burning and ballistic flight trajectory of rockets. This research is directly relevant to the problem of estimating jet plume effects on performance, stability and control of high acceleration rockets and missiles. Such problems have been identified as high priority advanced technology areas in the MICOM missile plan. In addition, it is relevant to the research activities at BRL in launch and transitional ballistics.

This program shall include theoretical analysis, computer program development, mathematical modeling, and selected experimentation aimed at establishing the merits of analytical and modeling concepts for jet plume-launcher wall interference, blow-back at breach, muzzle blast, and jet plume-slipstream interference.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0019, A FUNDAMENTAL STUDY OF A NEW FABRICATION TECHNIQUE FOR FIBER REINFORCED ALUMINUM MATRIX COMPOSITES 13847-MS

R. Mehrabian, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mechanical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DA0E9048; DAAG29-78-G-0067)

To sutdy the fundamental parameters of a new processing technique, consisting of incorporating discontinuous fibers into a partially solidified alloy before casting, for fabrication of metal matrix composites. The research is relevant to the fabrication of fiber reinforced, metal matrix composites for Army applications, such as lightweight portable bridges, transmission housings for helicopters, and structural bulkheads for ground vehicles (armored personnel carrier). There is a potential application for the hubs for the super flywheel project at MERDC.

The program will include (1) determination of the effect of processing parameters on microstructure, interphase interface characteristics, wetting of the fiber by the matrix, and mechanical properties of the composite, (2) determination of the effect of composite composition (fiber type, matrix alloy, volume fraction of fibers) and internal structure (fiber length, distribution, alignment, and orientation) on the mechanical properties of the composite, and (3) development of models to describe the reactions at the fiber-matrix interface.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0020, PSEUDOMEASURES - CHARACTERIZATION OF THE BASIC SIGNAL PROCESSING CAPABILITIES OF DIGITAL AND SAMPLED DATA SYSTEMS

R.J. Leake, University of Notre Dame, School of Engineering, Dept. of Electrical Engineering, *Notre Dame, Indiana* 46556 (DF044050; AFOSR-76-3036)

AF function - to advance the theory and application of digital signal processing, filtering, estimation, and detection, which are so important in communications, sensors, and surveillance systems. Deficiency - although the many advantages of digital circuitry are well established, the implementation of the technology

is often much too expensive for the expected return. Objective - to extend the theory of sampled digital systems to better understand quantized data-processing, digital controllers, and other concepts that were so important in classical circuit theory. How work contributes - success in this research would result in improved and more economical military electronic systems.

The theory of generalized functions, which includes Fourier analysis of more general functions that the classical theory, will be used as a tool to extend the important sampling theorem of Shannon, and to study the stability properties of digital filters and control devices. A new concept on quantizers is also to be perfected that will include the various devices now in use and which will permit the evaluation and analysis of quantized digital filters in a more accurate manner than has been possible heretofore.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, A SYSTEM STUDY FOR THE APPLICATION OF DISTRIBUTED PROCESSORS TO FLIGHT TESTING TECHNIQUES

G.L. Kelley, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Electrical Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NSG 4026)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Dryden Flight Research Center

4.0022, DRAG REDUCTION/DELIVERY TRUCK

V.U. Muirhead, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NSG 4023)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0023, EVALUATION OF AIRCRAFT SEPARATION ASSURANCE CONCEPTS, DISPLAYS AND AVIONICS EQUIPMENT

Unknown, Arnic Research Corp., *Annapolis, Maryland* 21401 (FA78WA-4091; FA161204 (TRAIS NO.))

The contractor shall furnish all of the personnel, materials, services, equipment and facilities for evaluation of pilot performance and commercial aircraft operation when operating with Aircraft Separation Assurance (ASA) avionics, This program will be structured in two parts: (1) simulation; and (2) preparation for operational testing.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0024, EFFECTS OF SHOCK LOADING VARIABLES ON SHOCK-WAVE STRENGTHENING OF METALS 13183-MS

D.E. Mikkola, Michigan Technological University, School of Engineering, Dept. of Metallurgical Engineering, *Houghton, Michigan* 49931 (DA0T5573; DAAG29-78-G-0005)

To determine the effects of shock loading variables upon the microstructure and properties of materials and to make a detailed comparison of laser-induced shock wave effects with those associated with mechanically introduced shock waves. Relevance - the proposed research has relevancy to hypervelocity impact research on projectiles and armor, and to the laser effects on materials as described in the Army's laser hardened materials and structures plan (1974).

Detailed studies will be made of the microstructural and substructural effects caused by changes in pulse duration during shock loading of metallic alloys, a quantitative examination of the relationship between structure and properties of shock-loaded materials, and will include studies of how various time-dependent flow mechanisms partake in the deformation process. Both laser shocking and mechanical shocking studies would be performed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0025, LASER DIAGNOSTICS OF METALLIC PLASMAS

D.R. Bach, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Nuclear Engineering, *Ann Arbor, Michigan* 48104 (DF039640; AFOSR-74-2713)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand advanced equipment unavailable to date. Deficiency - present day information is inadequate to design the aforementioned equipment. Such information may be obtained from experimental and theoretical work in metallic (collisional) plasmas. Objective - this project will investigate experimentally various laser diagnostic methods on high density metallic plasmas. Both exploding wires and Z pinch plasmas will be investigated, specifically aluminum and tungsten wires. Contribution - this work is a part of a comprehensive program on plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and ion beam), the development of space and ionospheric communications and the development of countermeasures.

This project will use the information obtained from lithium exploded wire plasmas to extend it to higher Z wire plasmas of aluminum and tungsten in the investigation of low energy x-ray emission from the plasma. These x-ray emission measurements will be compared with the calculations of Drs. Ong and Duderstadt (AFOSR grant 76-2904). The explosion wire system will be rebuilt in such a way that the plasma can be heated in the radial direction by using the high intensity CO2 laser in the axial direction in order to simplify the geometry to perform better comparisons between the calculations and experiments. Attempts will also be made to determine the geometrical shape of the x-ray emitting regions using x-ray pinhole photography.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, AERODYNAMIC AND ELECTROMAGNETIC PROPERTIES OF PLASMAS

L. Cesari, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Mathematics, *Ann Arbor, Michigan* 48104 (DF046970; AFOSR-77-3211)

AF function - design of advanced aerospace vehicles. Deficiency -more critical design criteria requires more exact evaluation involving additional physical effects. Objective - increased understanding of satellite environment and structure. How work contributes - by developing solution techniques for problems in shock waves in fluids and plasmas, chemical reaction and diffusion, optical resonance, nonlinear elastic deformation and buckling, etc.

At present nonlinear problems are to a large extent treated individually although subclasses of such problems, their properties and their solution techniques are being characterized. Theoretical and numerical AF relevant examples in bifurcation aspects of three-dimensional viscous fluid flow - plasma, optical, water, and atmospheric waves and shock waves - reaction diffusion systems, nonlinear elasticity and buckling, etc., chosen for their importance in the development of a general theory, will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, SIMPLIFIED INERTIAL GUIDANCE DEMONSTRATION (SIG-D)

J.P. Laughlin, Vought Corp., Michigan Division, *P.O. Box 909, Sterling Heights, Michigan* 48077 (DA0F1235; DAAK40 76 C 0669)

The technical objective is to design, manufacture, test and deliver three flight demonstration missile airframes with pneumatic controls to be utilized as flight demonstration vehicles to test low cost strapdown guidance techniques.

The airframe will use solid propellant motors manufactured during the Greener Pastures Program, empty Lance E-11 warheads for the nose section, and modified midsection for guidance system mounting. Aft-mounted pneumatic controls using four elevons for control will be developed. Midship wings and aft

tail/elevon surfaces are being designed based on wind tunnel tests. The government will integrate a ring laser gyro strapdown inertial guidance system into the airframe for feasibility demonstration flight testing.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Guidance & Control Directorate

4.0028, ELECTRON LITHOGRAPHY STAR DESIGN GUIDELINES

W.H. Causey, Mississippi State University, School of Engineering, Dept. of Electrical Engineering, *Suite 101 Engineering Bldg., Mississippi State, Mississippi* 39762 (NAS 8-33450)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

4.0029, DEVELOPMENT OF PARTIAL CHANNEL FLOW FOR ARBITRARY INPUT VELOCITY DISTRIBUTIONS USING BOUNDARY-FITTED COORDINATE SYSTEMS 13675-EX

L.R. Hester, Mississippi State University, School of Engineering, Dept. of Aerospace Engineering, *Suite 101 Engineering Bldg., Mississippi State, Mississippi* 39762 (DA0E9022; DAAG29 76 G0144)

To develop numerical solutions for time-dependent, two-dimensional incompressible laminar partial channel flow. This investigation is directly relevant to research on fluidic devices, utilized for example in such Army applications as helicopter and tank stabilization systems, being conducted at HDL and impacts on the techniques for modeling of flows in rivers, estuaries, and coastal seas being carried out at Waterways Experiment Station.

A numerically generated curvilinear coordinate system having a coordinate line coincident with the boundary contour will be utilized for solving the Navier-Stokes equations of viscous fluid mechanics describing flows through arbitrarily shaped channels.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0030, PROCESSING MECHANISMS, STRUCTURE, AND MORPHOLOGY OF HIGH-TEMPERATURE POLYMERIC ALLOYS

I.L. Hay, Celanese Corp., *Box 1000 Morris Ct., Summit, New Jersey* 07901 (DF047260; F49620-77-C-0046)

AF function - advanced Air Force lightweight aircraft, missile and satellite systems will utilize structural matrices and adhesives which will provide high performance at elevated temperatures in extreme service environments. Deficiency - the most stable polymer systems are relatively intractable and difficult to process by current fabrication techniques. Objective - the principles and mechanisms underlying the alloying of intractable, high-temperature polymers will be investigated. How work contributes - it is expected that this research will yield combinations of polymers that are more readily fabricable and have high temperature properties similar to the major intractable components.

Research will center on (1) the processibility of intractable polymers when alloyed with compatible polymers and monomers, (2) correlation of the particulate form and character of polymer mixtures before hot pressing with physical and mechanical properties after consolidation, and (3) the assessment and utilization of various experimental techniques to characterize the chemical and physical interactions occurring during processing and to establish the chemical nature of the polymer alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, STUDIES OF SLENDER, AXIALLY SYMMETRIC BODIES AT INCIDENCE AT HIGH REYNOLDS NUMBERS 14254-E

S.M. Bogdonoff, Princeton University, Graduate School, *205 Nassau Hall, Princeton, New Jersey* 08540 (DA0F9113; DAAG29-77-G-0234)

To experimentally investigate the flow field about two axisymmetric configurations, a tangent Ogive-cylinder and a secant Ogive-cylinder, at low incidence using a high Reynolds number supersonic wind tunnel. Relevance - experimentally obtained data for three-dimensional turbulent boundary layers on axisymmetric bodies at incidence is urgently needed for verification of recent theoretical developments at BRL. Such data would be quite useful in validating theories for design of Army missiles and projectiles.

Both surface and flow field measurements will first be made on a tangent Ogive-cylinder model at Mach 3 and a Reynolds number of approximately 1.6 million per inch, at incidence angles of 2 degrees and 4 degrees. Measurements will be made at 30 degree increments of Azimuth angle at 4, 5, and 6 diameters from the model tip and similar measurements will then be made for a second nose geometry.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0032, NONLINEAR PROCESSES IN PLASMAS

R.M. Kulsrud, Princeton University, School of Engineering & Applied Sciences, Dept. of Astrophysical Sciences, *Box 430, Princeton, New Jersey* 08540 (DF040390; F44620-75-C-0037)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of the nonlinear evolution of energy transformations in plasmas. Deficiency - the aforementioned information required for the design of advanced equipment is not available today. Its acquisition may be realized by a well planned theoretical and experimental research program. Objective - this program will investigate nonlinear collective phenomena, such as anomalous transport phenomena, linear wave absorption, and plasma wave turbulence, both in the laboratory and in space. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications and the development of countermeasures.

This project will perform theoretical calculations, analyze, evaluate and correlate the available experimental results of laser plasma interactions, solar wind plasmas, ionospheric plasmas, acceleration processes and runaway electron plasmas. Specifically it will investigate (a) the problem when "islands" in plasmas appear in two forms, either as magnetic "islands" in configuration space, or as "islands" of near resonance in phase space. The islands may be sporadic but their presence causes rapid diffusion, (b) the nonlinear evoluation of the tearing instability made with specific reference to the development of magnetic island structures and to move violent processes such as disruptive instabilities and rapid magnetic reconnection, (c) various types of solitary wave structures which develop in the very large amplitude turbulence associated with rapid heating methods in laser interactions, (d) it will also develop numerical techniques for elucidating the properties of runaway electron discharges and the instabilities observed in laboratory situations and (e) it will continue the study of electron density striations in the ionosphere and their relation to communication problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0033, SPEED-DEPENDENT COLLISION EFFECTS ON RADAR BACK-SCATTERING FROM THE IONOSPHERE

O.H. Theimer, New Mexico State University, Las Cruces Campus, School of Arts & Sciences, Dept. of Physics, *University Park, Las Cruces, New Mexico* 88003 (NSG 7622)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

4.0034, PROPOSAL TO VERIFY ROCKET EXHAUST PLUME EFFECT SIMULATION TECHNIQUES 13797-E

C.F. Reid, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DA0F8934; DAAG29 77 C 0008)

To investigate the validity of a cold jet simulation of rocket exhaust plume effects by direct experimental comparison between hot and cold jet base and afterbody pressures and between calculated pressures based on cold jet modeling and measured hot jet pressures. Relevance -the research is directly relevant to the understanding of plume effects on missile aerodynamics which is important because of the possible adverse effects of plumes and because of the potential for improving the accuracy of free rockets. Such technology is one of the principal thrusts of the aeroballistics directorate at MICOM.

Base and afterbody pressure measurements and Schlieren photographs of the plume from a solid fuel rocket engine will be made and used for comparison with an analytical model based on cold jet simulation of the hot jet and with cold jet experimental measurements of similar quantities.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0035, INVESTIGATION OF MOLECULAR BEAM EPITAXIAL GROWTH OF COMPOUND SEMICONDUCTORS AND CONTACTS 15479-EL

L.F. Eastman, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DA0G8960; DAAG29-79-G-0036)

To advance the state of the art in compound semiconductor layers, Schottky barriers and ohmic contacts for electron devices. Relevance -this research will directly support an active program at ERADCOM/ETDL to improve materials technology for very high speed integrated circuits. Close cooperation between this principal investigator and ETDL has already been established.

To use molecular beam epitaxy (MBE) to grow bulk and layered structures. Characterize and analyze grown materials for metallurgical and electrical properties in order to improve quality needed for device application.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0036, FABRICATION OF GAINASP MICROWAVE TRANSISTORS

J. Frey, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (NSG 1642)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0037, BASIC TECHNOLOGY OF SQUEEZE-FILM DAMPERS FOR ROTOR-DYNAMICS CONTROL 15657-E

C.H. Pan, Shaker Research Corp., *Northway 10 Executive Pk., Ballston Lake, New York* 12019 (DA0F9245; DAAG29-78-C-0027)

To study and analyze the squeeze-film damper as a means of stabilizing rotor shafts and reducing vibration and shock excitation. Relevance - dampers of the type studied are needed to control vibration of rotors.

To perform an analytic formulation and solution of the system, including cavitation; and verify the solution experimentally.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0038, LASER-INDUCED FLUORESCENCE 12211-P

R. George, Duke University, School of Engineering, Dept. of Electrical Engineering, *Durham, North Carolina* 27706 (DA0D9232; DAHC04-74-G-0067)

Investigation of fundamental parameters associated with the use of laser-induced fluorescense in remote sensing. This program is related to the use of laser-induced fluorescence techniques to spoof camouflaged material in reconnaisance applications.

The preliminary investigations will involve assembling a basic facility for evaluating the optimum wavelengths for excitation of various target materials. Parameters to be studied will include those associated with the laser transmitter, the target material, and the detector.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0039, INVESTIGATION OF D-REGION BACKSCATTERING PROCESSES 11054-GS

W.A. Flood, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Electrical Engineering, *Raleigh, North Carolina* 27607 (DA0D9299; DAAG29 76 G0138)

To conduct a comprehensive investigation of the accuracies of ground-base radio techniuqes for sounding the motions and electron densities in the ionospheric D-region between 6 km and 110 km. Upper air winds affect rocketry (BRL, MICOM, ASL) and ionospheric drifts affect communications (e.g., VLF communications program). This ground-based technique for wind measurement in the 60-110 km interval could replace the wind measururements of the cooperative meteorological rocket network with obvious advantages.

Specific studies include A) assessment of the validity of the randomly phased angular spectrum approximaton as it applies to HF radio wave ionospheric drift measurements, B) determination of the amplitude and distribution of D-region echoes as a function of altitude and pulse length, C) investigation of the presence and cause of orthogonally polarized D-region echoes, and D) determination of the cone angle of arrival of D-region echoes and correlation of the cone angle measurements with the orthogonally polarized D-region echoes.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0040, PRE-COOP ENGINEERING EDUCATION PROGRAM

D.W. Chenelle, Case Western Reserve University, Graduate School, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (NGT 36-027-790)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

4.0041, PRE-COOP ENGINEERING EDUCATION PROGRAM

W.C. Cathie, Carnegie Mellon University, Graduate School, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (NGT 39-087-790)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

4.0042, APPLICATIONS OF BOUND AND MODE APPROXIMATION TECHNIQUES FOR LARGE DEFLECTIONS OF PULSE LOADED STRUCTURES 15427-E

P.S. Symonds, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DA0F9201; DAAG29-78-G-0085)

To find methods for estimating large plastic deflections due to pulse or impact loading of engineering structures. Relevance - Army structures such as components of helicopters, vehicles, etc. are subject to large strains resulting from impulse loading. Improved methods of analysis would be useful to designers of such equipment.

Two methods of approximation will be used: (1) bound, and (2) mode. The former replaces the dynamic problem by a static one, and energy theorems are used to obtain bounds on the solu-

tions. The latter depends on the development of the solution in terms of instantaneous modes or shape functions obtained from the governing equations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0043, WIND TUNNEL TESTS OF DEMONSTRATION ROCKET

Unknown, U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center, *Arnold Air Force Station, Tullahoma, Tennessee* 37389 (DA0G1011)

To perform aerodynamic design of low cost rocket.

Wind tunnel tests will be performed on free rocket configurations.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Free Flight Rocket Technical Office

4.0044, MISSILE VORTEX WAKE MEASUREMENTS 14921-A-E

K.E. Harwell, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Aerospace Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DA0F8968; DAAG29 77 G0107)

To measure the three velocity components, the turbulent intensities and the turbulent correlations in the separating boundary layer and vortex wake regions on missile bodies at high angles of attack. Relevance - the proposed investigation will provide fundamental information on the origin of forces experienced by violently maneuvering missiles and is directly relevant to the design and development of tactical missiles.

The measurements will be made in the NASA/Marshall 7-inch square subsonic/supersonic wind tunnel facility and will utilize the NASA three-dimensional laser Doppler velocimeter system. Data will be analyzed and compared with existing analytical models to provide validations and improvement.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0045, STUDY RELATIVE TO DEVELOPING A MICROWAVE ANTENNA POINTING ERROR SENSING SCHEME

J.C. Hung, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Electrical Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAS 8-33604)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

4.0046, AN ANALYTICAL STUDY OF POWERED MISSILE AERODYNAMIC PERFORMANCE 14966-A-E

J.M. Wu, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DA0F8972; DAAG29 77 G0108)

To develop calculation techniques as well as a basic phenomenological understanding that allows the aerodynamic characteristics of realistic missile configurations to be estimated and optimized. Relevance - the understanding and prediction of the aerodynamics of canard-body-fin configurations at angle of attack is of greatest relevancy to the design and development of high performance tactical missiles and therefore has great impact on the Army's need for greater firepower.

Utilizing existing potential flow analyses, viscous flow past missiles at angles of attack will be determined including the effects of fins, fin tips and wake interactions. The resulting model will be utilized to examine aerodynamics of canard-fin-elevon combinations including effects of blunt noses and small geometric imperfections.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0047, ROBUST PARAMETER ESTIMATORS FOR COMMUNICATION DATA

P. Papantoni Kazakos, Rice University, School of Engineering, Dept. of Electrical Engineering, *6100 Main St., Houston, Texas* 77001 (DF046340; AFOSR-77-3156)

AF function - radio multi-access communications, remote sensing, image encoding schemes and radar signature recognition. Deficiency -improvements are needed in the techniques of signal estimation and image processing in the presence of unpredicted interferences and abrupt changes. Objective - develop estimators that are 'robust' in the presence of statistically 'contaminated' communication data. How work contributes - this research will allow for better design of communication systems and signal processing techniques.

A big percentage of the communication channels in the literature have been modeled as Gaussian and additive, in the term 'channel' one incorporates all disturbances and measurement errors that are undesirable and which one must get rid of. The main reason for the Gaussian and additive assumptions in modeling is analytical simplicity. However, communication channels are often subject to abrupt changes. Therefore, realistically speaking, even when the channel can be modeled successfully as additive, one almost never has a very accurate knowledge of the true underlying distribution. Taking this under consideration together with the fact that the performance of some of the classical parametric tests or estimates for some information retrieval is very unstable under small changes of the underlying distribution, the need for study and design of receivers (or estimators) insensitive to such changes becomes evident. This need has been recognized by statisticians and engineers, and that is how the nonparametric and robust concepts were created. However, although tests with small sensitivity to distribution changes have been proposed and analyzed, the area is far from being exhausted. Indeed, the nonparametric property has been treated separately from the concept of robustness, although they should be connected. The subject of this proposal is the design of estimators that are 'robust' in the presence of statistically 'contaminated' communication data. A radical approach to the concept of robustness is used. A precise detailed definition of statistical contamination is given. Such definition is very sensitive to the distance between probability measures that are used. Robustness is defined as a stability property inside certain contaminated families. Constructive analysis of robustness as defined above leads to methods for designing 'robust' estimators where the concept is not vague any more.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0048, SPREAD SPECTRUM MULTIPLE ACCESS TECHNIQUES AND MICROWAVE MOBILE RADIO COMMUNICATIONS

S.C. Gupta, Southern Methodist University, School of Engineering & Applied Sciences, Dept. of Electrical Engineering, *Hillcrest & University, Dallas, Texas* 75222 (DF048010; AFOSR-77-3277)

AF function - the interference rejection and inherent message privacy properties of spread spectrum communications is of great significance to military communications as it provides a large measure of protection from active countermeasures by an enemy. Opportunity -current spread spectrum systems are too costly to be incorporated into the tactical air forces. Objective - the proposed research will investigate new spread spectrum concepts for advanced communication systems and explore the applications of these concepts to practical systems, including microwave mobile communications and military satellite communications. How work contributes - this effort will advance spread spectrum techniques for military communications.

Further simulation work will be performed to establish the practical limits on the new acquisition technique that was developed which employs an autoregressive parametric model and a variable wave digital filter. A comprehensive mathematical analysis will be performed on a spread spectrum multiple access technique for satellite communications. Finally, the problem of data transmission, at microwave frequencies, over mobile radio channels will be studied. The use of spread spectrum systems will be investigated and compared to conventional systems. Various modulation and encoding schemes will be comparatively evalu-

ated to determine the data rates that can be supported over mobile radio channels in very hostile propagation environments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0049, DESIGN STUDIES FOR A TECHNOLOGY ASSESSMENT RECEIVER FOR THE GLOBAL POSITIONING SYSTEM

J.H. Painter, Texas A & M University, College Station Campus, School of Engineering, Dept. of Electrical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NSG 1639)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0050, DENSE PLASMA HEATING AND RADIATION GENERATION

M. Kristiansen, Texas Tech University, School of Engineering, Dept. of Electrical Engineering, P.O. Box 4340, Lubbock, *Texas* 79409 (DF038180; AFOSR-74-2639)

AF function - operation of high latitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of dense plasma heating and radiation generation processes. Deficiency - the aforementioned information required for the design of advanced equipment is not available today. Its acquisition may be realized by a well planned theoretical and experimental research program. Objective - this project will perform theoretical and experimental investigations on (A) CO2 laser interaction with preformed plasmas, and (B) nonlinear optical mixing in plasmas. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications and the development of countermeasures.

This research will investigate dense plasma heating and radiation generation. This will follow two main routes: (A) CO2 laser interaction with preformed plasmas employing the laser obtained from AFWL coupled with an intracavity to enhance laser absorption. For diagnostics of the new plasma source they will use Twymann-Green and Mach-Zehnder interferometers, fast photography, spectroscopy, and diamagnetic loops. They may also use Thomson scattering. In addition to hydrogen they will use high Z materials to enhance the x-ray generation. (B) Non-linear optical mixing in plasmas will be performed by the two counterstreaming laser beams which are expected to heat the plasma by inverse bremsstrahlung. One of the most important goals of the experimental investigation is to determine the threshold for exciting various plasma instabilities that can either absorb the laser energy or scatter it out of the interaction volume. The required power densities for the onset of various possible nonlinear mechanisms is rather large. They will start a theoretical investigation of heating to determine if waves other than the Langmuir plasma wave might be more suitable to be driven by the laser beat frequency. They will use the operator formulation (Markuvitz) to calculate the excitation coefficients of various waves that might fall in the appropriate range. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0051, HIGH INTENSITY SOUND

D.T. Blackstock, University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, *200 W. 21st, Austin, Texas* 78712 (DF042700; F44620-76-C-0040)

AF function - advanced aerospace vehicles. Deficiency - lack of basic understanding of nonlinear sound waves. Objective - achieve a fundamental understanding of the behavior of finite-amplitude (i.e. very intense) acoustic waves and apply this understanding to important problems of defense technology. How work contributes - major sources of nonlinear waves under investigation are jet and rocket engines. Understanding of this phenomenon and how the frequency spectrum changes with distance will enable the Air Force to remove or at least lower the noise level found around aircraft and air fields.

Research in high intensity sound will be carried out in three areas: 1) propagation of finite-amplitude noise; 2) propagation of periodic waves; and 3) diffraction, reflection, and focusing of N waves. This will be a combined theoretical and experimental program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0052, SUBSONIC AERODYNAMIC LOADS ON MISSILES 13164-E

A.H. Nayfeh, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Mechanics, *Blacksburg, Virginia* 24061 (DA0Q5576; DAAG29 76 G0034)

To utilize discrete-vortex techniques to treat the subsonic aerodynamic interactions between the components of missile-like configurations. The design programs at MICOM for most missiles and rockets would benefit from this research program. Two major thrust areas, free flight rocket program and terminal homing program, would be particularly benefitted. At BRL, the proposed work would be applicable to the flow about the tail fins of low velocity mortars.

The discrete-vortex technique will be extended to interactions of wings having arbitrary planforms, positions, and orientation as well as to wing-body interactions. Quantitative comparisons with experimental data will determine the accuracy of the predicted interactions effects.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0053, UNSTEADY AIRLOADS ON A SINUSOIDALLY OSCILLATING SUPERCRITICAL AIRFOIL

H. Tijdeman, National Aerospace Lab., *Amsterdam, Netherlands* (DF048340; AFOSR-77-3297)

AF function - aerospace vehicles. Deficiency - there is a lack of reliable experimental unsteady aerodynamic data at transonic speeds. These data are required for analysis and for validation of unsteady transonic aerodynamic theories. Objective - to obtain accurate unsteady aerodynamic measurements at transonic speeds on two-dimensional airfoils. Unsteady wall effects will also be investigated. How work contributes - unsteady transonic aerodynamic data are required for evaluation of flutter characteristics of aircraft, flutter characteristics of helicopter rotor blades, gust response of aircraft, performance of helicopter rotor blades, and design of active control systems. The acquisition of accurate unsteady aerodynamic data in which the effects of model scale and facility wall configurations will be evaluated should serve as a standard for the comparison and evaluation of the new generation of calculation methods for unsteady transonic flow.

This is a collaborative program between NASA Ames and the NLR (which has requested nominal Air Force support for their portion of the program). The NLR 7301 airfoil will be investigated in both the NLR transonic tunnel and the NASA Ames 11 by 11 foot transonic wind tunnel. Both the NLR and NASA Ames tests will investigate the amplitude and phase relationships of the pressure distribution and the resultant integrated forces over a range of Mach numbers, angles of attack, Reynolds numbers and reduced frequency. Sufficient data and details of the test facilities pertinent to evaluating wall and scale effects will also be provided as well as details of the test techniques including data acquisition and reduction procedures. It is expected that the close cooperation of the two research laboratories will result in greater progress to improve data accuracy and reliability in a shorter period of time than would be possible by each group working independently.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, THE EFFECTS OF TOPOGRAPHY, ALBEDO AND THERMAL INERTIA VARIATIONS ON THE GENERATION OF MESOSCALE MARTIAN WIND PATTERNS

R.L. Rankin, Arizona State University, School of Engineering & Applied Sciences, Dept. of Engineering Science, *Tempe, Arizona* 85281 (NSG 7630)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0002, IMAGE RECONSTRUCTION USING LARGE ASTRONOMICAL TELESCOPES

P.A. Strittmatter, University of Arizona, School of Liberal Arts, Dept. of Astronomy, Tucson, *Arizona* 85721 (DF248810; F19628-78-C-0058)

AF function - communications, surveillance, detection, tracking. Deficiency - severe limitation in observing fine spatial details on deep space objects. Objective - to utilize new and existing techniques used in observational stellar astronomy to assist in solving Air Force needs in the areas of satellite identification and monitoring. How research contributes - enables the Air Force to increase spatial resolution through the atmosphere by a factor of over fifty.

A data acquisition system to obtain short exposure astronomical photographs used in the technique known as 'speckle interferometry'. This system will be used to obtain test and evaluation data on both man-made space objects (satellites) and non-man-made objects (stars, asteroids and extended nebulae). These data will be used to develop and perfect data processing schemes to recover images with spatial detail approaching the best theoretically possible in the absence of atmospheric turbulence.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0003, FUNDAMENTAL STUDIES IN GEODYNAMICS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0004, ESTABLISHMENT OF A SAMPLE TREATMENT PROTOCOL FOR VIRUS DETECTION BY LASER FLUOROMETRY

G.A. Funk, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Biological Science, *Washington Sq., San Jose, California* 95192 (NSG 2398)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0005, STRATOSPHERIC POLLUTANT TRANSPORTS BY PLANETARY WAVES AND TROPICAL CIRCULATIONS

C.A. Riegel, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCC 2 17)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0006, QUANTITATIVE MODELS OF THE TOTAL DENSITY OF THE DISTURBED UPPER ATMOSPHERE AND THE DISTURBED MAGNETOSPHERIC MAGNETIC FIELD

W.P. Olson, McDonnell Douglas Astronautics Co., *5301 Bolsa Ave., Huntington Beach, California* 92647 (DF040430; F44620-75-C-0033)

AF function - accurate models of the earth's magnetic field and the distribution of the earth's neutral atmosphere are needed to accurately predict nuclear weapons effects in the aerospace environment. Deficiency - current models are inadequate for the precise predictions needed. Objective - models will be derived utilizing coordinate systems that will easily interface with existing computer codes. Contributions -these models will improve the accuracy of prediction of nuclear weapons effects.

Existing models of the magnetospheric magnetic field and the density of the neutral upper atmosphere will be improved so that they are useful over the full range of magnetic conditions. Input parameters to the models will be chosen such that the models be used in a predictive mode. In line with this program the following will be accomplished: 1) quantitatively determine position and strength of the three magnetospheric current systems as a function of appropriate parameters describing the variability of each current. 2) by vector integration compute for each current system its associated vector magnetic field in the magnetosphere. 3) using vector B at a grid of points develop an analytic representation for both vector B and its associated vector potential, vector A, valid at least throughout the inner magnetosphere. 4) modify the existing quiet atmospheric density program to include disturbance effects with storm time dependencies included as appropriate. 5) extend the range of the quiet atmosphere density program to an altitude of 1000 km using available data to check and verify the extension.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0007, TRACKING AND MONITORING OF HURRICANES BY HF SKYWAVE RADAR OVER THE GULF OF MEXICO

J.W. Marescz, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DF044800; F49620-76-C-0023)

AF function - the Air Weather Service has a technical need for remote measurement of tropical cyclone parameters. Deficiency - in the early developing stages of a tropical cyclone, the center of the cyclone, as determined by satellite data, can be displaced from the surface center by as much as 100 nautical miles. At nighttime, the coarser resolution of the satellite IR sensor presents problems in locating the tropical cyclone. Objective - HF radar technology will be used for remote sensing of the sea surface conditions and surface winds in tropical cyclones. Contribution - the availability of a remote wind sensing capability with OTH radar will permit a significant reduction of the weather reconnaissance flights with little or no degradation of the present existing forecast capability. This will be a cost effective measure.

The SRI radar (OTH) will be used as an active radar. The tropical storm area will be illuminated by a beam of radio waves originating at this radar transmitting site, and the radio waves reflected (backscatter) from the storm area are detected by a highly directional antenna located at the radar receiving site. The recorded backscatter data will be analyzed to track and monitor hurricanes to determine the sea state and surface winds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0008, VERY-LOW-FREQUENCY PROBING OF THE MAGNETOSPHERE FROM PALMER STATION, ANTARCTICA

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DPP7682042A02)

This is a continuation of NSF Grant Number DPP76-82042.

The very-low-frequency (VLF) wave receiving system established at Palmer Station, Antarctica, during the austral summer of 1977-78 will continue to operate during 1979 and early 1980 to obtain data on natural VLF-wave activity and on the magnetospheric response to signals injected from Siple Sta-

tion, Antarctica. The data taken at Palmer Station during transmissions from Siple will support ground-to-satellite transmitting experiments during the International Magnetosphere Study now under way. VLF-direction finding experiments will also be conducted at Palmer along with observations for VLF-wave induced particle precipitation. Two scientists will visit Palmer during the austral summer of 1979-80. One of these will winter-over during 1980.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0009, MAGNETOSPHERE-IONOSPHERE-ATMOSPHERE INTERACTIONS
R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (ATM7820967)

This grant supports the investigation of magnetosphere-ionosphere-atmosphere interactions for a two year period. The approach to be used involves both theoretical and experimental work. In the experimental area, the primary source of data will be a field program of active and passive probing of the magnetosphere-ionosphere system at Siple, Antarctica, and Roberval, Quebec, Canada. In addition, analysis of correlative data from a number of other ground-based and satellite programs will be performed. Major scientific problems to be investigated include (1) wave-induced particle precipitation and its effects on the ionosphere, (2) the origin of VLF waves in the magnetosphere, with particular emphasis on the role of man-made VLF noise in stimulating wave activity in the magnetosphere, (3) longitudinal wave-particle interactions in the magnetosphere, and (4) substorm electric fields in the plasmasphere and their effects on the ionospheric F region.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0010, OPTIMIZATION OF AN INTERACTIVE BATCH ANALYSIS SETUP SYSTEM FOR LANDSAT APPLICATIONS
A.M. Peterson, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (NCA 2-745910)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0011, INTERPLANETARY FIELD STUDY
I.A. Kinsey, University of California, Berkeley Campus, Space Sciences Lab., *3 Leuschner Observatory, Berkeley, California* 94704 (DF247230; F19628-76-C-0125)

AF function - communications and detection. Deficiency - understanding ionospheric effects caused by various auroral phenomena which cause communications degradation in the Arctic. Objective -investigate the effects of the interplanetary magnetic field on various auroral phenomena. How research contributes - provides inputs to in-house work efforts in substorm prediction and ionospheric mapping. This contractual effort is for investigation of the IMF and its relationship to various auroral phenomena and the predictive indications inherent in the IMF behavior. Interpretation of IMF parameters in terms of auroral phenomenology provides a background for the interpretation of data collected by the AFCRL Airborne Ionospheric Observatory.

Assemble and interpret IMF data to specify a given ionospheric state and structures associated with the chosen state. To correlate the specific states and structures with DMSP photos and aircraft data. To identify any precursor states or structures which warn of impending substorms or other magnetic disturbances.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, SHIP AND SATELLITE BIO-OPTICAL RESEARCH IN THE CALIFORNIA BIGHT
R.C. Smith, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (NSG 1641)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0013, ONE-TIME GRANT FOR MAJOR UPGRADING AT JICAMARCA
B.B. Balsley, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (ATM78-17663)

This grant provides major upgrading of the data processing capability for aeronomical and meteorological research done at the Jicamarca Radio Observatory. The Observatory has importantly unique research capabilities by virtue of its geophysical location at the magnetic equator and its instrumental capabilities. These unique research opportunities have led to the maintenance of a long standing substantial U.S. research effort at the Observatory by a large number of first rate U.S. scientists. By replacing old worn-out units with their modern counterparts, the capability of this Observatory and the efficiency of the dependent research programs are significantly enhanced.

The improved reliability and order of magnitude increase in data handling capability provided by this grant will correspondingly enhance research in the areas of: 1) Dynamics of the Neutral Atmosphere, including measurement and analysis of winds, waves, and turbulence in troposphere, stratosphere, and mesosphere; 2) Structure and Dynamics of the Equatorial F Regions; 3) Equatorial F-Region Irregularities (Spread F) with emphasis on the explanation of the experiments at Jicamarca and which are so severe as to interfere with radio communications in the very high GHz range; and 4) Equatorial Electrojet Irregularities (Equatorial Sporadic E).

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0014, METEOROLOGY STUDIES OF MARS
S.L. Hess, State University System of Florida, Florida State University, Geophysical Fluid Dynamics Inst., Dept. of Meteorology, *205 Wildwood Dr., Tallahassee, Florida* 32306 (NSG 7629)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0015, COLOR INFRARED APPLICATIONS TO CITRICULTURE
C.H. Blazquez, State University System of Florida, University of Florida, School of Agriculture, Dept. of Plant Pathology, *Gainesville, Florida* 32601 (NAS10-9666)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Kennedy Space Center

5.0016, SHIPBOARD TECHNICIAN SUPPORT
J. Gibbons, University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, *4600 Rickenbacker Cswy., Miami, Florida* 33149 (OCE7726357A01)

This grant will provide partial support for the activities of the Marine Electronics Group at the University of Miami's Rosenstiel School of Marine and Atmospheric Research. Principal activities supported by the grant include the maintenance of complex shipboard electronic gear essential to research sponsored by the National Science Foundation as well as integration and utilization of computerized data collection and satellite communication systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0017, OZONE TRANSPORT IN THE LOWER STRATOSPHERE AND THE OZONE-NO2 RELATIONSHIP
D.M. Cunnold, Georgia Inst. of Technology, Graduate School, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NSG 1643)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0018, NIMBUS 7 APPLICATIONS INVESTIGATION
Unknown, Georgia Inst. of Technology, Graduate School, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAS 5-25817)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0019, SHORT COURSES IN REMOTE SENSING
R. Welch, University of Georgia, Graduate School, Dept. of Geography, *Athens, Georgia* 30601 (NAS13-123)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0020, RESEARCH OF PRECIPITATION GROWTH IN CONVECTIVE CLOUDS
R.C. Srivastava, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (NSG 5402)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0021, NORTHERN PLAINS OF MARS
J.R. Underwood, Kansas State University, School of Arts & Sciences, Dept. of Geology, *Anderson Hall, Manhattan, Kansas* 66502 (NSG 7613)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0022, GEOLOGY OF LIBYAN DESERT GLASS SITE, S.W. EGYPT
J.R. Underwood, Kansas State University, School of Arts & Sciences, Dept. of Geology, *Anderson Hall, Manhattan, Kansas* 66502 (NSG 7580)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0023, DETECTION OF BURIED SURFACES ON MARS
Unknown, Northeast Louisiana University, Graduate School, *700 University Ave., Monroe, Louisiana* 71201 (NSG 7628)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

5.0024, RESEARCH OF HIGH TEMPERATURE SOLAR CONVERTER
F.W. Oliver, Morgan State University, Graduate School, Dept. of Physics, *Hillen Rd. & Cold Spring Ln., Baltimore, Maryland* 21212 (NSG 5401)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0025, CONFERENCE ON THE REGIONAL APPLICATIONS OF REMOTE SENSING TECHNOLOGY
Unknown, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NAS 5-25851)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0026, AIRBORNE WATER VAPOR LIDAR EXPERIMENT
T.D. Wilkerson, University of Maryland, College Park Campus, Inst. for Fluid Dynamics & Applied Mathematics, *College Park, Maryland* 20742 (NCC 1 25)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0027, RESEARCH LEADING TO THE DEVELOPMENT OF INSTRUMENTATION FOR RESEARCH ROCKETS SUPPORT AND INSTALLATION AT ROCKET LAUNCH SITES
S.J. Rochefort, Northeastern University, School of Engineering, Dept. of Electrical Engineering, *360 Huntington Ave., Boston, Massachusetts* 02115 (DF247220; F19628-76-C-0111)

AF function - research leading to the development of state-of-the-art airborne instrumentation systems. Deficiency - the inability to accurately forecast the atmospheric interactions affecting the design and operation of military systems in the area of rockets and satellites. Objective - to perform studies leading to the design, construction and flight test of state-of-the-art airborne instrumentation systems. Such studies will attempt to improve present day systems by more efficient utilization of transmission bandwidths. Provide field support - carry on post-flight analysis of performance and provide continuing improvement. How research contributes - the development of more efficient airborne data processing techniques and instrumentation systems will allow more efficient use of RF bandwidth within the limited allowed band.

Theoretical development of more efficient telemetry systems for use in rocket, satellite and balloon instrumentation systems. Construct these telemetry systems for flight - provide field support and carry on post-flight analysis of performance. The closed loop will ensure rapid response to current needs. The design objectives concern space, weight and power. The vast experience accumulated through previous contracts should ensure efficient use of valuable Air Force funds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, ELECTRONICS FOR ULTRAVIOLET SPECTROMETER
C.G. Kuczun, Tri Con Associates Inc., *Cambridge, Massachusetts* (DF249990; F19628-77-C-0048)

AF function - vehicle tracking during flight and re-entry, trajectory prediction, communication systems. Deficiency - present atmospheric models predict only slight variability of the density of the upper atmosphere below 200 km; however, empirical data show this conclusion to be incorrect and observations indicate density changes as great as 50 percent in both space and time at altitudes between 120 and 200 km. This altitude, important for Air Force operations, will be studied on a world-wide basis by density experiments aboard the DMSP satellites. The present work will support these experiments. Objective -in-situ measurements with rockets of atmospheric parameters to provide correlative data for comparison with photometric data from DMSP satellites. How research contributes - provides direct, low-altitude measurements of pertinent atmospheric properties as an aid in understanding the remote optical measurements made from DMSP satellites.

Contractor shall design, fabricate and test an electronics subsystem for a double-deck solar EUV spectrometer and auxiliary experiments (a UV photometer, a dayglow photometer and an electron analyzer), modify ground support equipment consoles for the spectrometer and the photometers, and assist in the preparation of the rocket payload for flight. Measurements will subsequently be made from a rocket in the altitude range between 120 and 200 km. of the photoelectron flux, differential energy distribution for energies between 0 and 100 electron volts, of the radiance of nitrogen airglow at 3371 Angstroms and of the density and composition of the upper atmosphere as established by solar ultraviolet photon absorption rates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, ADVANCED WEATHER RADAR DIAGNOSTIC SOFTWARE
C.L. Bjerkaas, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581480)

AF function - protection of aerospace systems in severe storms. Deficiency - identification and warning of storm hazard by current methods are unreliable and require ineffective utilization of projected reduced manpower. Objective - to develop software suitable for the operational detection of meteorologically significant features of storms and the prediction of storm movement, development, and severity. How development contributes - provides improved identification and prediction of convective storm hazards using automated data processing techniques for storm diagnosis.

Algorithms for detecting radar indicators of severe weather phenomena will be developed based on radar data taken in Oklahoma during the joint agency Doppler tests in the spring of 1977. The algorithms will be operationally tested during the spring 1978 test and modified based on the test results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, LANDSAT STUDY OF URBAN AND LAND USE - JACKSON, MS

M. Lang, Jackson State University, School of Liberal Studies, Dept. of Social Science & Educational Geography, *1325 Lynch St., Jackson, Mississippi* 39217 (NSG 736)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

5.0031, CLIMATIC MISSION SUCCESS INDICATORS

D.E. Martin, St. Louis University, School of Engineering, Dept. of Earth & Atmospheric Sciences, *3507 Laclede Ave., St. Louis, Missouri* 63103 (DF248330; F19628-77-C-0032)

AF function - support weather sensitive Air Force and Army mission. Deficiency - current climatology needs to be adapted to expeditiously meet the input requirements for indicators of mission success. Research - apply statistical theory and computer methods to the climatic record. How research contributes - will contribute to a military capability to assess the climatic influence anywhere, at any time, worldwide, upon the probabilities of the successful completion of an Air Force mission.

Develop and test stochastic models for estimating joint or conditional probabilities of weather events including events with time lag between them, all of which will be favorable for the successful completion of a multiphased Air Force mission. The weather events are those relevant at take-off, enroute and at one or more destinations and their alternates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, STRATOSPHERIC DISCHARGES

R.E. Orville, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Atmospheric Science, *1400 Washington Ave., Albany, New York* 12222 (DF580040; F19628-78-C-0007)

AF function - environmental impact statements of high-altitude Air Force operations. Deficiency - current or anticipated AF operations in the stratosphere may deposit harmful materials and it is important to assess the potential impact of this in the context of the harmful substances deposited naturally by such things as thunderstorms. Objective - to perform an experimental study of glow discharges associated with lightning in thunderstorms but which occur above the storm in the stratosphere. How research contributes - this work would establish the existence and some of the characteristics of these discharges. Such discharges may be having a significant effect upon the chemistry of the stratosphere. They may in fact be generating large amounts of NOX there, but comparatively little is known about the phenomenon at present. The work would also be important for future aircraft operations when they have the ability to fly over thunderstorms. This is because it is possible that they may experience or even initiate clear air stratospheric discharges. A third area of relevance is that of navigation, surveillance, and communication since these can be affected by electrical activity.

The experimental program will center around an optical approach involving still and cine photographs as well as spectroscopic investigations using filters and multichannel recordings. A comparison of certain spectral lines will prove or disprove the existence of the clear air stratospheric discharges. Vehicles such as high altitude aircraft and balloons will allow detection of the phenomenon from above the thunderstorms. Both ground-based and airborne observations will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, STATISTICAL MODELLING OF SURFACE WATER MOVEMENTS USING RADAR ALTIMETER DATA

C.C. Tung, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Civil Engineering, *Raleigh, North Carolina* 27607 (NAS 6-3018)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0034, A SECOND YEAR OF EFFORT IN ESTABLISHING LANDSAT WORKSHOP

J.A. Harrington, University of Oklahoma, Norman Campus, Graduate School, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (NAS13-122)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0035, THE ROLE OF DIABATIC HEATING IN GENERATING LOWER TROPOSPHERIC MESOSCALE CIRCULATION 13817-GSX

R.A. Anthes, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (DA0E9047; DAAG29 76 G0157)

To investigate the role of differential heating at the earth's surface and N-producing mesoscale circulations. This research is relevant to the Army Automated Meteorological System (AMS) requirement for development of the technology base on small-scale atmospheric processes.

Prediction of atmospheric behavior in the planetary boundary layer will be determined using a complex three-dimensional, multi-level primitive equation model modified to realistically account for vertical fluxes of heat and momentum, and a simpler two-dimensional analog to the 3-D model. The role of differential heating at the earth's surface will be stressed in this comparison.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0036, MEASUREMENT OF REFLECTIVITIES OF ROCKS, MINERALS AND GLASSES IN THE VACUUM ULTRAVIOLET

B. Hapke, University of Pittsburgh, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (NSG 7631)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0037, ADVANCED MICROWAVE SOIL MOISTURE STUDIES

J.L. Heilman, South Dakota State University, Graduate School, *Brookings, South Dakota* 57006 (NSG 5396)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0038, ROCKETBORNE ELECTRON SOURCE

W.R. Pendelton, Utah Higher Education System, Utah State University, School of Science, Dept. of Physics, *Main Bldg., Office 104, Logan, Utah* 84321 (DF580550; F19628-78-C-0103)

AF function - detection. Deficiency - lack of knowledge of atmospheric processes controlling infrared and optical backgrounds. Objective - a rocketborne electron source will be designed, fabricated and tested for eventual integration in a rocket payload designed to determine specific atmospheric parameters by means of electron induced optical emissions. A rocketborne Echelle spectrometer will measure relative band intensities, band profiles and absolute band intensities of specific molecular emission excited by a rocketborne electron source. The emissions will be interpreted in terms of CO2, O2 and O and N2 atmospheric densities as well as N2 rotational and vibrational temperatures. How research contributes - the rocket payload measures a series of atmospheric parameters that control infrared

4.3 micron CO2 emission in both auroral and nuclear disturbed atmospheres. The results provide insight into the spectral, spatial and temporal nature of IR backgrounds under auroral and nuclear disturbed conditions.

A rocketborne electron source will be designed and fabricated to provide a beam of electron induced optical emissions to be observed by a rocketborne Echelle spectrometer. The spectrometer measures the molecular band profile and photon emission rate of selected molecular emissions induced by an energetic beam of electrons. The electron source energy and current and the spectrometer are designed as a compatible system with the measurement precision of the ambient atmospheric parameters the principal design criteria.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0039, DYNAMICS OF THE HIGH LATITUDE IONOSPHERE

W.J. Raitt, Utah Higher Education System, Utah State University, School of Science, Dept. of Physics, *Main Bldg., Office 104, Logan, Utah* 84321 (DF248300; F19628-77-C-0011)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of plasma flows, charge distributions, electric fields for the design needs of AF systems. Objective - study high latitude ionospheric dynamics in three areas: 1. High latitude F region dynamics, 2. Convection electrodynamics, and 3. Polar wind. How research contributes - provides data essential to HF and UHF propagation predictions, provides data required for the design and utilization of communication guidance and surveillance systems and provides understanding of the dynamical processes in the ionosphere.

Develop theoretical procedures and computer codes to determine plasma flow, particle distributions and effects of electric fields on the high latitude F region. Satellite data will be utilized to test the theoretical methods and to develop a prediction capability for the high latitude ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0040, CLOUD AND PRECIPITATION PARTICLE SIZE SPECTRA 15420-GS

L.F. Radke, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Sciences, *Seattle, Washington* 98105 (DA0G8929; DAAG29-79-G-0005)

To obtain measurements and relate liquid and solid particle size spectra in clouds and precipitation to the mesoscale structure of storms, the mechanism by which precipitation is produced, the effects of moisture supply, air motion and changes in the particle spectra produced by topography. Relevance - many E-O weapon and communication systems are sensitive to attenuation by liquid and solid particles in clouds and precipitation. Liquid and solid particle size spectra also are important in rain and ice crystal erosion, icing of aircraft, and prediction of cloudiness and precipitation.

As a subtask of a larger cycles project, use airborne and ground-based instrumentation to measure size spectra of solid and liquid cloud and precipitation particles as they move from over the Pacific Ocean into Washington State. Combine these measurements with other simultaneous measurements and observations from satellites, two instrumented aircraft, four weather radar (two Doppler), serial radiosondes, and a dense network of precipitation rate measuring gages to analyze cloud and precipitation microphysics.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0041, AEROSOL LIFE CYCLES AND RELATED ATMOSPHERIC PROCESSES

M.B. Baker, University of Washington, School of Engineering, Dept. of Civil Engineering, *206 Guggenheim Hall, Seattle, Washington* 98105 (ATM78-08163)

The processes by which materials are cycled through the troposphere determine their spatial and temporal distributions, as well as their physical and chemical properties. This study will perform an analytical investigation of a selected set of aerosol cycles. The optical effects of each aerosol are derived from models of the dominant cycle mechanisms. Determination of the sensitivity of these optical effects to uncertainties in the data leads to quantitative characterization of the major data requirements. The cycles are examined both from a deterministic and a stochastic point of view. Measured variability in input parameters is incorporated into models which predict the statistical properties of the time-dependent and steady-state particle concentrations. The techniques thus developed are generalized and applied to a class of mathematically similar atmospheric phenomena.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0042, SATELLITE OBJECTIVE FORECASTING

D.R. Johnson, University of Wisconsin, Madison Campus, Graduate School, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DF581920; F19628-78-C-0137)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of information to meet military weather support requirements. Objective - to develop automated techniques which utilize meteorological satellite data and where necessary, conventional data in the objective specification and forecasting of mesoscale weather features. How development contributes -successful development of these techniques will allow automated forecasts of weather conditions at many locations satisfying AWS requirements specified in AWS TN 3-76.

Objective techniques will be developed using both satellite and conventional data. Use will be made of interactive data display systems to assist in identifying features of the satellite imagery and conventional data analyses that have potential as predictors. Tests will be made to evaluate how well forecasts with satellite data alone compare with those using conventional data as well.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0043, A REMOTE JOB ENTRY TERMINAL PROCESSOR

D.D. Houghton, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (ATM7818095)

Research programs in the University of Wisconsin Meteorology Department and Space Science and Engineering Center (SSEC) have in recent years involved large computational tasks. These include parameterization and simulation studies with NCAR and Goddard (formerly GISS) general circulation models, analysis and forecast with operational prediction models, and analysis of large volumes of observational data from satellite aircraft, and climatological data archives. Research for at least the next ten years will continue to be focused in areas such as these that rely heavily on external computer support. This equipment grant will allow to continue more effectively the present and future research and teaching in meteorology at this university. The proposed RJE facility will be part of an intelligent processor capable of emulating a variety of terminal disciplines, will allow the flexibility of communicating with virtually any scientific computing facility, will link directly to the data base manager in SSEC, and with future additional peripherals. The terminal could serve as an applications processor to a Mcidas type (Chatters and Suomi, 1975) system and as such would serve as a valuable tool in meteorology department teaching.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0044, MEASUREMENT OF FLUOROCARBONS, NITROUS OXIDE, AND AEROSOLS IN THE ANTARCTIC STRATOSPHERE

D.J. Hofmann, University of Wyoming, School of Arts & Sciences, Dept. of Physics & Astronomy, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (DPP7721202A01)

This is a continuation of NSF Grant DPP77-21202.

Balloon soundings to measure aerosols, condensation nuclei, nitrous oxide and fluorocarbons in the Antarctic stratosphere will be conducted at McMurdo and South Pole stations during the austral summers of 1978/79 and 1979/80. The data obtained will be used to (1) extend the existing data base and determine if seasonal and secular trends exist in their concentrations, (2) assess the effects of volcanic activity on the stratosphere and provide information on interhemispheric transport and exchange processes in the upper atmosphere, and (3) determine the importance of condensation nuclei on clear sky ice crystal precipitation in the Antarctic.

Logistics support is required for five persons at McMurdo and South Pole stations during the austral summers of 1979-80.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, POPULATION DYNAMICS IN SMALL-SCALE MICROBIAL ECOSYSTEMS

R.D. Haight, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Biological Science, *Washington Sq., San Jose, California* 95192 (NCA 2-675907)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0002, NEUROPHARMACOLOGICAL EVALUATION OF TOXIC CHEMICALS

M.B. Sterman, University of California, Los Angeles Campus, School of Medicine, Dept. of Anatomy, *2025 Zonal Ave., Los Angeles, California* 90033 (DF319630; F33615-76-C-5014)

The 6570 AMRL has been investigating the pharmacological and toxicological effects of certain missile propellants in order to more safely use such compounds in a manner dictated by good industrial hygiene and industrial medical practice. In order to set standards for exposure criteria and to determine methods for combating the effects of those propellants and chemicals in exposed individuals, it is necessary to determine the exact mode of action of the agents on specific body function. The specific objective is to study the effects of hazardous chemicals of interest to the USAF on behavior responses in laboratory animals, obtain data on performance, correlate behavior changes with other neurological events, and test the efficacy of therapeutic measures to abort untoward effects of the agents.

A study will be conducted to advance the state-of-the-art with respect to the central nervous system effects of toxic chemical compounds of interest to the USAF. Previous studies in this regard have been performed using the cat as the primary model. Research with the cat has indicated a need to change the primary model to a primate for comparative purposes. It is now evident that certain forms of chemically induced epileptic manifestations are better studied in the primate. The specific agent to be studied using primate models will be the propellant, methylhydrazine. The data will be utilized to study mechanisms of action of the compound as well as various therapeutic regimens necessary to abort toxic manifestations. The data will also help develop toxicity criteria for the USAF as required by AFR 19-1.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0003, THE EVALUATION OF STRUCTURAL AND CHEMICAL ALTERATIONS OF BONE AND RED BLOOD CELLS IN THE RESTRAINED MONKEY MODEL

A. Furst, University of San Francisco, Inst. of Chemical Biology, Dept. of Chemistry, *Golden Gate & Parker Ave., San Francisco, California* 94117 (NCA 2-670902)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, RESPONSE OF THE CARDIOVASCULAR SYSTEM TO VIBRATION AND COMBINED STRESSES

C.F. Knapp, University of Kentucky, School of Engineering, Dept. of Mechanical Engineering, *Limestone & Euclid, Lexington, Kentucky* 40506 (DF037240; F44620-74-C-0012)

AF function - environmental stresses such as acceleration may severely compromise aircrew performance. Circulation may be extended to critical limits since it is directly affected by acceleration and is indirectly involved in all adjustment of the body to environmental stress. Deficiency - with the recent development and deployment of high speed terrain-following tactical aircraft, operational crews are exposed to a dynamic acceleration environment with a significant frequency content below 1.5 Hz for extended periods of time. There is an acute lack of information available concerning responses at frequencies below 1.5 Hz. The design of effective countermeasures to acceleration stress depends upon the understanding of the mechanisms responsible for cardiovascular regulation. Because of the invasive nature of the instrumentation required for assessing cardiovascular responses, studies will be performed using chronically instrumented canines. Objective -the proposed studies are designed to 1) yield needed quantitative information about the cardiovascular system's ability to function in, and adjust to, ultra low frequency acceleration environments, and allow a qualitative evaluation of the possible hazards of exposure to such acceleration stress, and 2) to provide a means of analyzing the frequency response of the cardiac and vascular control mechanisms, acting to maintain circulatory integrity, during exposure to these dynamic, total-circulatory (i.e. whole body) acceleration loadings. How research contributes - this effort will provide the background required for the design and implementation of human investigations which would lead to improved protective equipment and operational procedures for military personnel exposed to the acceleration environment resulting from the optimal utilization of advanced aerospace systems.

Emphasis will be placed on the use of pharmacologic blocking agents to identify the frequency response of neural and adrenal mechanisms associated with cardiovascular regulation. The frequency response characteristics will be obtained from the magnitude of the physiological changes and their phase relationship to the acceleration loadings through the use of Fourier analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0005, HIGH Q WINDBLAST FORCES ON MAN

L. Specker, Payne Inc., *Annapolis, Maryland* (DF323000; F33615-77-C-0523)

The forces acting on the ejecting crewman entering the windstream during emergency escape are the second most frequent major cause of all injuries experienced during ejection. Injuries attributed to windblast flail are encountered in 5.6 to 6.9 percent of all survived ejections, while 54 percent of ejections in the 450 to 600 KEAS range result in major injuries or fatalities. As the performance envelope of advanced aircraft systems is expanded, windblast injuries will probably become more common. With the advent of the newer bubble canopies, windblast forces are encountered before the crewman is clear of the aircraft. The data that have been collected on crewman during emergency escape have been limited to that portion of the escape sequence in which the crewman was exposed to free-stream conditions. One-ninth scale model wind tunnel tests of the F-16 aircraft have indicated that the environment within the cockpit before entry into the high speed windstream is potentially hazardous. The aerodynamic forces are increasing in magnitude and the turbulence levels encountered may seriously compromise the crewman's chance of survival before rescue. The objectives of this program are to provide measurements of the aerodynamic forces that are encountered during the initial and transitory phases in the turbulence about the cockpit in order that effective protection countermeasures can be developed.

The program will combine an analytical effort with a wind tunnel scale study. The model will be used to collect pressure and force data needed to quantify inertial and aerodynamic forces acting on the ejecting crewman to cause injury and the development of requirements for the design of personnel protection systems. The analytical effort will allow for the analysis of the

wind tunnel data as well as exploring the use of various testing facilities and techniques for windblast research.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0006, DEVELOPMENT OF HUMAN PERFORMANCE MODELS FOR MAN-MACHINE SYSTEM SIMULATION

R.W. Pew, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF042440; F44620-76-C-0029)

AF function - whatever the precise form of the final RPV operational capability, timely and reliable performance of human components will be critical to mission success. The most responsive design of an RPV system requires valid data on the functioning of the human operation. Deficiency - previous efforts have not provided information specific enough for detailed design of the total complex of rules, procedures and decision-making which must support new, more stringent system functions. Consequently, the task of combining human performance data in the solution of the man-machine reliability equation and, thereby, of assaying alternative system configurations cannot be satisfactorily accomplished. Objective - BBN proposes to develop and test improved models of human performance. These models are to be integrated with structure models of the tasks associated with control of RPV systems being developed by AMRL. How research contributes -promising models in sufficient detail for AMRL implementation and evaluation of their usefulness will identify subsystem model parameters having greatest influence on system performance. By exercising these models, systems engineers can predict the effects of changes in system parameters before proceeding to full-scale simulation efforts and the operational evaluation of prototype systems.

Modelling studies will be conducted in collaboration with AMRL/Human Engineering Division personnel to explore quantitatively and in detail several key issues in model development. Recommendations and guidelines will be prepared concerning the most suitable approaches, and resolving ambiguities in the application of simulation models in future model development programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0007, NOISINESS AND ANNOYANCE OF NOISE-TONE COMPLEXES

R.D. Hellman, Boston University, Graduate School, *705 Commonwealth Ave., Boston, Massachusetts* 02215 (NSG 1644)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

6.0008, EFFECTS OF SLEEP DEPRIVATION ON THE CENTRAL NERVOUS SYSTEM

A.K. Sinha, College of Medicine & Dentistry of New Jersey, Rutgers Medical School, School of Medicine, Dept. of Physiology, *Box 101, Piscataway, New Jersey* 08854 (DF051050; AFOSR-78-3532)

AF function - Air Force operations expose personnel to a wide range of physiological stresses including prolonged missions with altered work/rest cycles. Varying levels of fatigue and performance degradation may occur as a result of such conditions and thus could impact on the efficiency of aircrew members and support personnel. Deficiency - sleep loss and fatigue due to extended missions occur in many Air Force operations. The ability to reduce crew rest requirements would be a significant application of this research effort. Objective - it is generally accepted that dramatic and incapacitating behavioral changes take place in human subjects due to prolonged sleep deprivation. It is assumed that the behavioral decrement due to sleep loss is a consequence and symptomological expression of cellular and subcellular level changes taking place in the brain cells during the deprivation period. The long term objectives are to detect and describe some of these changes, to explore the possibility of reversing them (thereby reversing or minimizing the functional decrement) by chemical intervention and to determine if qualitatively some biochemical changes take place during cyclic alterations between normal sleep and wakefulness. How research contributes - this research will provide essential information on the effects of sleep deprivation on central nervous system integrity. Findings will be applied to the establishment of rest recovery procedures for flight crews/support personnel and will feed in to related on-going in-house 6.2 efforts at USAFSAM.

A variety of stressful situations is known to stimulate neuroprotease (lysosomal) activity. This generalization suggests that neuroprotease activity in brain will increase following sleep deprivation. A number of conditions (exercise, starvation, infection, hypoxia) and chemicals (progesterone, vitamin A, hyperbaric oxygen) are known to cause simultaneous increase in neuroprotease activity and sleeping time. Based on these observations this effort proposes the following working hypothesis: prolonged wakefulness or sleep loss increases neuroprotease activity, which causes subcellular disorientation in brain cells and is behaviorally manifested in sleepiness and associated behavioral decrement. This hypothesis will be tested by light and electron-microscopic survey of morphological changes in brain cells due to prolonged sleep loss. *(Text Abridged)*

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, VCASS HELMET-MOUNTED DISPLAY DESIGN

M. Shenker, Farrand Optical Co. Inc., *New York, New York* (DF323770; F33615-78-C-0512)

The objective of this program is to accomplish an optimized system design for an extremely wide field-of-view (FOV), virtual image, head-coupled display system for the Visually Coupled Airborne Systems Simulator (VCASS) Program. This device will be utilized in conjunction with head and eye position sensing mechanisms and computer generated imagery subsystems to develop a wide FOV virtual scene simulator for engineering and training simulation applications.

The approach will be to develop a weighted matrix using appropriate analytical techniques which give in an engineering sense a figure of merit when related to the specified design criteria. When the matrix has been completed and design criteria are set a comprehensive study of potential design approaches will be made. The design approach which appears most promising will be selected for detailed analysis. Finally a detailed technical specification complete enough to allow fabrication of the design by any knowledgeable manufacturer of optics and display systems will be prepared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0010, INDIVIDUALIZED OXYGEN DELIVERY SCHEME

E.A. Patrick, University of Cincinnati, Graduate School, *305 Physics Bldg., Cincinnati, Ohio* 45221 (DF319700; F33615-77-C-0603)

The contractor is to identify and select several physiologically sound schemes for enhancement of an ideal oxygen delivery process that will provide the individual crew member with physiologically adequate amounts of oxygen while simultaneously ensuring optimal oxygen supply conservation. An accurate, reliable methodology, convertible to lightweight hardware at a later date, must be continuously changing flow demands imposed by the airborne crew member during various exposures of acceleration, altitude, and workload.

The eventual remedy to current hardware limitations must be based on development of alternative methodologies for oxygen delivery that can later be implemented with hardware fabrication. The starting point for this effort, to be detailed in this statement, should consist of (1) nomination and theoretical evaluation of candidate concepts for matching instantaneous oxygen delivery with crew member demand, (2) mathematical simulation of the two most promising schemes, as chosen by a panel of physiological investigators currently active in aerospace medicine endeavors. This suggested approach is necessarily contingent on respiratory property and response data that is available from qualified sources. The end product of this effort is expected to be a functional, physiologic-based scheme for accurately controlling the inflight delivery of oxygen, with maintenance of optimal crew member performance serving as the guiding criterion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0011, MYOELECTRIC FEEDBACK CONTROL OF VISUAL DISPLAY DIMMING

D. Rogers, University of Dayton, Graduate School, 300 College Park Ave., Dayton, Ohio 45469 (DF228480; F33615-77-C-0080)

To design and develop a bionic controlled feedback system for controlling the acceleration induced dimming of a simulator pilot's visual environment including the visual display and instruments. Such training devices as the simulator for air-to-air combat (SAAC) have visual display dimming capabilities to simulate the vision loss of a pilot under high positive acceleration. However, this sytem is not pilot interactive, the pilot has no physiological (M-1 maneuver) control over the display. State-of-the-air simulators provide no means for a tactical aircraft simulator pilot to control visual display dimming as a function of g. This effort will result in a technique by which pilot straining (M-1) can be sensed and the signal used to control the g effect dimming of simulator visual displays.

The approach is to develop the software and hardware (electrodes and package) to include the pilot in the visual display/simulation control loop. Two algorithms will be developed. One will predict the human visual systems's response to both antecedent and current g-levels. The other will predict the pilot's increased g-tolerance as a function of his ability (which will be determined by monitoring electromyographic potentials from selected muscle groups) to perform the M-1 maneuver. Development of this algorithm will require experimentation with trained subjects to determine which muscle groups are the most reliable indicators of the effectiveness of the M-1 maneuver. The two algorithms will be integrated to drive a brightness controller for the pilot's visual field. The integrated system will be implemented on the T-38 simulator at the AFHRL Stars facility. If successful, the system may be refined and integrated with the simulator for air-to-air combat (SAAC). Model development complete - 8 MAC; electrode development complete - 9 MAC; integrated controller operational - 10 MAC; system delivered, integrated on stars - 11 MAC; final report - 12 MAC.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0012, BONE GROWTH AND ALTERATION VIA ENDOSSEOUS IMPLANTS

I.L. Kamel, Drexel University, School of Engineering, Dept. of Materials Engineering, 32nd & Chestnut Sts., Philadelphia, Pennsylvania 19104 (NAS 9-15915)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Johnson Space Center

6.0013, PROCEDURAL TESTS FOR ANTI-G PROTECTIVE DEVICES

R.W. Thompson, Technology Inc., 8531 N. New Braunfalo Ave., San Antonio, Texas 78217 (DF320570; F33615-77-C-0610)

The purpose of this effort is to provide more definitive data on standard and experimental anti-g valve operational characteristics. In addition a failure analysis life expectancy of g valves will be undertaken. The final products will be (a) the development of a standard experimental technique for evaluating anti-g valves, (b) a standard analytical approach for evaluating g valves, and (c) a failure analysis/life expectancy prediction of a g valve.

The contractor will impose various onset rates of g and absolute g levels to g valves using the SAM centrifuge while also modifying flow rates of air and inlet pressures of air to the valve. Using these experimental techniques he will develop and test an anti-g valve test protocol for reliability and producibility as a standard test procedure. Also using this technique, he will test standard and experimental valves in various modes of failure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0014, POWER AND CONTROL CONFIGURATIONS FOR A HIGH G-ONSET CENTRIFUGE DRIVE SYSTEM

T.J. Jones, Trinity University, Graduate School, Dept. of Engineering Science, 715 Stadium Dr., San Antonio, Texas 78212 (DF052510; AFOSR-78-3622)

AF function - aircrew personnel operating high performance aircraft are exposed to increasing levels of rapid onset, sustained, repetitive maneuvering forces which can impose certain physiological responses that can affect operator performance in aerial combat. There is a need to conduct research utilizing test facilities such as the human centrifuge that will simulate these high g forces at levels of g and at rates of onset that match those of present or planned high performance aircraft. Deficiency - for a human centrifuge to provide an adequately realistic simulation of the environment of flight, the pilot to be trained must have control of the g force imposed, as he would through the control stick in an aircraft. In addition, for optimum simulation, the centrifuge should be capable of producing g onset rates from one g to several g per second. Objective - this research will investigate centrifuge power and control configurations which provide pilots (gondola subjects) controlled high g onset rates capable of simulating aerial combat maneuvers in new high performance aircraft. How research contributes - a research centrifuge's power and control system should, as much as possible, simulate the g forces, and g onset rates, produced by high performance fighter aircraft during aerial combat maneuvers. Any modifications, or new or additional gear necessary for achieving aerial combat maneuver simulation should be incorporated in a manner making them maximally compatible with existing equipment. This work supports subarea 1.6, 'habitable crew environments in AF operations.'

This study will be carried out by gathering data and specifications on available power equipment, and using this information in an analysis which will contain the mathematical model of the centrifuge arm and gondola. Methods of control will be included in the overall model. In this manner a number of possible solutions to the problem of pilot-controlled high g onset rates can be obtained. Both all-electric and hydraulic power systems with appropriate controls for each will be considered. Computer programs analyzing the system are to be run on Trinity University's IBM 370/155 computer. Standard programs employing CSMP as well as ones written using APL or FORTRAN would be used in the analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0015, APPLIED PREDICTIVE MODEL FOR HUMAN EXPOSURE TO THERMAL STRESS IN USAF OPERATIONS

E.H. Wissler, University of Texas, Austin Campus, School of Engineering, Dept. of Chemical Engineering, 200 W. 21st, Austin, Texas 78712 (DF320430; F33615-77-C-0602)

This effort is designed to develop a computer model for predicting human response to the thermal stresses encountered in USAF operations. Use of such a model should permit prompt answers to questions from the field without the need for human experimentation, and should also serve to pinpoint critical areas where further investigation is indeed required. Although a number of programs on thermoregulation are already in existence, none is immediately suitable for USAF application. This effort will produce either a new model or a modification of an older one for this purpose.

The contractor will develop a digital computer program for predicting human response to thermal stress. The objectives of this contract are (1) to conduct a review of existing models to determine their suitability for this application, (2) to write a new program or modify an existing one to meet the technical requirements, (3) to provide computer programs written in FORTRAN, compatible with USAFSAM computer hardware, and (4) to compose a technical report summarizing the literature review and citing the experimental findings which form the basis for the model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0016, EFFECTS OF ANTI-G MEASURES ON GAS EXCHANGE

H.J. Modell, University of Washington, School of Medicine, Dept. of Physiology & Biophysics, *500 17th Ave., Seattle, Washington* 98122 (DF051920; F49620-78-C-0058)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including high sustained acceleration (HSG). It has been recognized that cardiovascular responses can be encountered which may be particularly important in determining performance capabilities in aircrew members. Although information is available concerning physiological effects of moderate exposure to g (up to 5g), little information is available at higher levels of g exposure such as might be experienced during aerial combat maneuvers flown in the F-15 and F-16 high performance aircraft. Deficiency - several questions remain to be answered relevant to high sustained g (HSG) tolerance if more effective protective measures are to be developed. This study will elucidate on the extent to which commonly used protective measures (e.g., anti-g suits, straining manuevers) enhance or impair ventilation-perfusion ratios and the development of atelectasis at 1g and during exposure to HSG, the time course of gas exchange detriment resulting from use of these protective devices, the means by which these measures can be modified to optimize gas exchange during HSG. Objective - the overall objective of this research is to determine the extent to which commonly used anti-g measures enhance or impair gas exchange at 1 g and during exposure to HSG. How research contributes - this research will directly feed-in to ongoing exploratory development work conducted at USAFSAM and is covered under sub-area 1.6, "habitable crew environments in Air Force operations."

Animal experiments designed to examine changes in ventilation-perfusion distribution and atelectasis will be conducted at 1g in the University of Washington laboratory and at HSG at USAFSAM. Protective measures to be examined include the anti-g suit abdominal bladder, positive pressure breathing, and the combined measures of anti-g suit abdominal bladder and positive pressure breathing. In addition to the experimental studies, the computer model of gas exchange presently under development for USAFSAM by Collins' study will be extended to include nonsteady state pulmonary gas exchange and effects of anti-g protective measures on ventilation-perfusion distribution and gas exchange.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0017, TASK LOAD AND OPERATOR ATTENTION CAPACITY IN TIME SHARING PERFORMANCE

D. Gopher, Technion, Israel Inst. of Metals, *Haifa, Israel* (DF046760; AFOSR-77-3131)

AF function - this research supports aircrew training, aircrew performance in high task load environments (e.g., combat), and overall force readiness. Deficiency - as the role of the pilot is shifting from a direct controller of aircraft functions to a monitor and decision-maker in a complex, dynamic, and intelligent man-machine system, we need to measure those abilities which support this new role. The increasing complexity of flight missions combined with the growing sophistication of airborne systems and the concurrent increase in production and training costs emphasize the need for improved assessment techniques for pilot attention capacity and task loads. Objective - the research activity will follow three major lines - (1) development of a quantitative assessment of time sharing efficiency, (2) training for time sharing, and (3) development of software packages, including feedback devices and adaptive techniques. How research contributes -improved techniques and prediction equations for the evaluation of task load and operator efficiency in time sharing situations will be utilized in system design and development, the structuring of aircrew training programs, and the assessment of the workload quotient of various tactical maneuvers.

In FY-78 the research will be devoted to achieving the following goals - (1) cross-validation and improvement of procedures developed during the first year, (2) expansion and diversification of the investigation of performance limitations by adding new tasks to the existing battery. Visual monitoring, memory, reaction time and dichotic listening tasks have been constructed and incorporated in experimental designs, (3) experimentally investigate both dual-task and triple-task conditions, (4) increase emphasis on developing theoretical concepts that can tie applied human factors research with the general theory of attention.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, BLENDING ELEMENT-DIFFERENCE SCHEMES

G.H. Golub, Stanford University, School of Humanities & Sciences, Dept. of Computer Science, *Stanford, California* 94305 (NCA 2-745912)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0002, STUDY ON ONE- AND TWO-DIMENSIONAL FILTERING AND DECONVOLUTION ALGORITHMS FOR A STREAMING ARRAY COMPUTER

G.E. Ioup, Louisiana State University, University of New Orleans, School of Arts & Sciences, Dept. of Physics, *1542 Tulane Ave., Lake Front, New Orleans, Louisiana* 70122 (NSG 1648)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0003, NONLINEAR OSCILLATIONS BY TOPOLOGICAL AND FUNCTIONAL ANALYTIC METHODS 12981-M

J.C. Scanlon, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Mathematics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DA0K5572; DAHC04-75-G-0148)

To determine useful conditions for the existence and stability of periodic and almost periodic solutions of ordinary and functional differential equations, and to study bifurcation phenomena in nonlinear problems. Relevance - the questions of existence and stability of periodic solutions of nonlinear problems arise in a variety of areas, e.g., flap-lag stability analysis of helicopter rotor blades. These problems are aggravated when hysteresis or material memory introduces a time lag into the system. Bifurcation studies serve a dual role, supporting the theoretical existence studies mentioned above and unraveling such practical problems as buckling and sudden changes of structural response due to the variation of a physical parameter.

To formulate these problems in an abstract function space and apply the methods of topological degree theory to the resulting operator equations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0004, EFFECTIVE BEHAVIOR OF COMPOSITE MATERIALS

G.C. Papanicolaou, New York University, Washington Square & University College of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (DF053040; AFOSR-78-3668)

AF function - aerospace vehicle design. Deficiency - design techniques for fastening composite materials. Objective - improved understanding of edge effects in composites. How work contributes -cracking and separation of laminates is influenced by stresses due to edge effects.

Asymptotic techniques including multispace and averaging have been used to obtain macroscopic equations for media with periodic fine structure like composites valid sufficiently far from edges. It is proposed to extend this work to areas including edge

effects, irregular structure with associated fluctuation equations, and humidity transport and associated swelling as for example in epoxy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, MATHEMATICAL MODEL (KRASH) OF CH-47A CRASHWORTHINESS

Y. BadriNath, Boeing Co., Vertol Division, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0D4040; DAAJ02-76-C-0015)

The objective of this program is to (1) simulate the dynamic response of a CH-47A helicopter to crash impact using computer program KRASH; (2) correlate the predictons of KRASH with data from a full-scale CH-47A crash test; and (3) recommend improvements to KRASH.

The structural response of a CH-47A to crash impact will be modeled using KRASH, and the initial impact conditions planned for a CH-47A full-scale crash test to be performed jointly by ATL and NASA at NASA's Langley Research Center. Following the test the model will be correlated with the test data and the CH-47A model improved. The contractor will recommend improvements to the KRASH computer program.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

7.0006, FINITE ELEMENT ANALYSIS OF TRANSONIC FLOWS 14371-M

G.J. Fix, Carnegie Mellon University, Mellon Inst. of Science, Dept. of Mathematics, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (DA0E9249; DAAG29 77 G0026)

To investigate the numerical solution of the partial differential equations describing transonic flow. Relevance - the subject matter has clear relevance to many Army flight problems including flows around rotors, missiles and artillery projectiles.

A new variational principle will be implemented which has certain desirable properties when used in conjunction with the finite element method. This variational principle will be investigated first in the two-dimensional case and then later in the three-dimensional case.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0007, CONTINUUM THEORY OF FRACTURE

M.E. Gurtin, Carnegie Mellon University, Mellon Inst. of Science, Dept. of Mathematics, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (DF043720; AFOSR-76-3013)

AF function - damage tolerance of advanced aerospace vehicles is essential to reductions in AF cost of ownership. Deficiency - new failure criteria are needed to accurately predict the fracture process under a wide range of materials (metals and composites) and environmental states. Objective - the objective of this research is to investigate new fracture theories for metallic structures and to apply continuum mechanics based upon basic energy balance considerations and diffusion to the durability of composites. How work contributes -research contributes to improved failure resistant designs for aircraft and solid propulsion vehicles.

Principal investigator is approaching the fracture problem as a rational treatment of energy balance. The energy of the fracture surface should be treated as a loss in binding energy caused by the creation of new fracture surfaces. Consideration will be given to the propagation of the fracture surfaces and the effects of temperature. Moisture absorption will continue to be investigated as a diffusion process in a deforming solid. Both moisture and temperature considerations will be included in the study. The influence of free and bound states of moisture in the solid will be studied, as well as interfacial diffusion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0008, RESEARCH IN DIFFERENTIAL GAME THEORY

M. Mintz, University of Pennsylvania, Moore School of Electrical Engineering, *203 Logan Hall, Philadelphia, Pennsylvania* 19104 (DF048690; AFOSR-77-3327)

AF function - research in differential game theory for conventional Air Force weapons systems. Deficiency - mathematical models for determining evasion strategies for an aircraft threatened by a multiple missile attack has not been fully investigated. Objective - the objective of this research is to develop an improved mathematical model which (1) accounts for the uncertainties and modeling errors associated with the dynamics of multiple pursuing missiles, and (2) leads to the determination of a suitably robust algorithm for specifying the optimal evasion strategies. How work contributes - success here would allow system operational planners to devise methods to avoid a hostile air-to-air or surface-to-air attack on planned air missions.

The proposed research will be divided into three related areas. First, the development of an improved mathematical model which accounts for uncertainties in the assumed missile dynamics which are used in the determination of the optimal evasion strategies will be investigated. Second, the computation of saddle-point solutions for the current mathematical/computer model developed under previous research which assumes simplified dynamics and perfect information will be pursued. Finally, there will be simulation studies to determine the sensitivity of the optimal evasion strategies to uncertainties in the underlying parameters dynamic structure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0009, ALGORITHM AND SOFTWARE DEVELOPMENT FOR MULTI-LEVEL SCHEMES FOR PARTIAL DIFFERENTIAL EQUATIONS

A.H. Sherman, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Computer Science, *200 W. 21st St., Austin, Texas* 78712 (NSG 1632)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, TIME-OF-FLIGHT MOLECULAR SPECTROSCOPY

W.E. Lamb, University of Arizona, School of Liberal Arts, Dept. of Physics, Tucson, Arizona 85721 (DF039720; AFOSR-75-2864)

AF function - this research contributes to RO 6.3, electromagnetic weaponry. Opportunity - the search for new lasing media will be facilitated if potential energy diagrams of candidate molecules are known. Objective - to make velocity-resolved studies of the production of metastable atoms from dissociating molecules and their de-excitation by collisions with other atoms and molecules. Contribution - this research has the capability of establishing the potential energy diagrams of a number of diatomic molecules of interest to new lasers.

A time-of-flight spectrometer is being used to obtain high-resolution electron-bombardment dissociation spectra and collisional quenching cross-section data for molecules of importance as reservoirs of potential energy which can be transferred to other lasing species.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0002, ENERGY TRANSFER REACTIONS OF EXCITED ATOMS AND MOLECULES 14708-C

G. Black, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DA0F9016; DAAG29 77 C 0018)

To determine the kinetics for reactions involving oxygen molecules and atoms with various species prevalent in the upper atmosphere. Relevance - the kinetic data to be determined will

have application in on-going Army programs in combustion, laser, and possibly in optical surveillance systems and in atmospheric modeling.

A range of spectroscopic techniques including photon counting, resonance fluorescence and absorption, time-resolved radiative decay measurements, pulsed flash lamps, and laser excitation will be utilized in the investigation to be undertaken.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0003, FUNDAMENTAL EXPERIMENTS AT LIQUID HELIUM TEMPERATURES

W.M. Fairbank, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (DF027070; F44620-75-C-0022)

AF function - the proposed research primarily falls in the 7.1 research objectives which deal with reconnaissance and surveillance. In particular the experiments involving the production and trapping of very low energy ground state electrons in a weak magnetic field lead to a photon counting millimeter wave detector. AF operations require the search and mapping of regions of interest in real- or near-real-time in order to detect, identify, locate, count or investigate weapons, personnel, vehicles, installations by microwave, electronic and other sensing methods. Deficiency - the far infrared portion of the electromagnetic spectrum is an underdeveloped area that potentially could contribute significantly to remote sensing. This probable interaction of such radiation with materials along with high atmospheric transmission in many bands and especially at the longer wavelengths gives rise to interest regarding potential reconnaissance or surveillance application. Objective - they propose to continue their investigation of the temperature-dependent anomalous shielding effect which we observe on the surface of a copper tube at liquid helium temperatures. During the present contract year they expect to conclude experiments which will determine the behavior of the shielding effect at temperatures below 4.2K (probably down to 2.5K or so) and which will yield improved measurements in the 4.2K-9 region. Contribution - this research is a part of a comprehensive program in low temperature physics.

During the next year the development of the electron/positron thermalizer as a photon counting detector will be continued. Optimization of the device for use in the surface shielding work will be directed toward operating the thermalizer with a positron beam. The problems of interfacing the thermalizer to the time-of-flight apparatus include minimizations of physical size, magnetic field matching and shielding of the high energy particles emitted by the radioactive source at the ejector stage of the thermalizer. Use of the thermalized electron source will allow significant improvements in counting statistics and because of the reduced time needed for data acquisition, will make it possible to perform many more experiments on the surface shielding effect.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, LOW TEMPERATURE PROPERTIES OF MATERIALS

N.E. Phillips, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720

The general objective is to obtain low-temperature heat-capacity data that contribute to an understanding of the relations between atomic properties and the macroscopic properties of materials. The materials investigated include normal and superconducting metals, superfluids, dielectric solids, and magnetic materials. Heat capacity measurements are confined to temperatures below 25K because usually only in that region can various contributions be reliably separated. Establishment of a temperature scale for the region from 0.06 to 25 K on germanium resistance thermometers is anticipated. For temperatures from 0.06 K to below 1 mK nuclear susceptibility and gamma-ray anisotropy thermometers will be used as primary thermometers. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0005, INTEGRATED-OPTICS CADMIUM/TELLURIDE ELECTRO-OPTIC MODULATOR FOR THE 10 UM REGION

R.Y. Chiao, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (NSG 1637)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0006, THE NEW PLASMAS AND THEIR APPLICATIONS TO PLANETARY MAGNETOSPHERES AND THE HELIOSPHERE

H. Alfven, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (NSG 7623)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0007, STUDIES RELATED TO DROPLET BURNING AT ZERO G

F.A. Williams, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (NSG 3296)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0008, MAGNETIC TEXTURES AND SURFACE EFFECTS IN LIQUID 3 HE AT ULTRA LOW TEMPERATURES

H.M. Bozler, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (DMR7900830)

This research is a continuation and extension of work supported by NSF Grant No. DMR7702160. Pulsed nuclear magnetic resonance techniques will be used to investigate magnetic textures in the A phase of superfluid helium-3. Several experiments will be undertaken to observe the effects of restricted geometries on these textures in order to test various aspects of the theory of solutions. Magnetic textures generated by heat flow will be studied to test predictions of current theories regarding the nature of textures in superfluid helium-3. Thermal conduction across boundaries between liquid helium-3 and metallic surfaces will be studied at temperatures as low as 0.4MK; such data will probe the effects of magnetic coupling on the thermal conductance across boundaries. Enhanced surface magnetism of helium-3 in contact with various substrates will also be investigated. This research is important for our fundamental understanding of quantum liquids and solids.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, QUANTUM ELECTRODYNAMICS OF SIMPLE ATOMIC SYSTEMS

P.J. Mohr, Yale University, Graduate School, *206 Elm, New Haven, Connecticut* 06520 (PHY7820776)

A research program in theoretical atomic physics will be initiated. Among the topics to be investigated are: 1. Radiative corrections and vacuum polarization effects for Coulomb field; 2. Structure of high Z two-electron atoms.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0010, THERMOPHYSICS OF SATELLITES AND ASTEROIDS

D. Morrison, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *2444 Dole St., Honolulu, Hawaii* 96822 (NSG 7633)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0011, MOLECULAR RADIATION PHYSICS--THEORETICAL STUDY OF SECONDARY-ELECTRON SPECTRA

Y. Kim, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (ANL 67100; ERDA RK-02-04-02)

The method is entirely theoretical, but the majority of the input data will be experimental. The results of this study will serve as a vital input to energy-degradation studies in progress in the Fundamental Molecular Physics and Chemistry section, as well as in radiation chemistry (in Chemistry Division of ANL). Also, this study will identify those areas in which more experimental data are needed. Such information will be relayed to experimental groups in and out of ANL.

SUPPORTED BY U.S. Dept. of Energy

8.0012, THEORETICAL RESEARCH

D.L. Price, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (59001; EE-02-02-03)

Theoretical research is an integral part of the solid state science division program, complementing the experimental research. Some of the theoretical activities involve direct collaboration with experimental activities at Argonne; some are based on experimental work at other laboratories; and some are devoted to developing methods and concepts for future experimental programs.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0013, NUCLEAR RESONANCE IN SOLIDS

R.G. Barnes, U.S. Dept. of Energy, Ames Lab., *Ames, Iowa* 50010

Applications of nuclear magnetic resonance, nuclear quadrupole resonance, and Moessbauer effect to the following are being studied: determination of hydrogen-isotope locations and diffusion parameters in hydride and deuteride phases of refractory metals (e.g., V, Nb, Ta), alloys (e.g., Nb--Ti, Nb--V), and compounds (e.g., Ta6W, V2C); electronic and structural phase transitions in refractory metal hydrides; interactions between hydrogen isotopes and interstitial impurities such as O, N, and C in refractory metals (V, Nb, Ta); characterization of lattice perfection and structural transformations in superconducting intermetallic compounds (e.g., NbSe2, HfV2); charge density wave effects in superconducting intermetallic compounds (e.g., NbSe2, TaSe2); and electronic structure of one- and two-dimensional metals (e.g., ZrCl, Sc7Cl10). (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0014, EVALUATION OF MEASUREMENT OF MICROWAVE BACKSCATTER COEFFICIENT WITH ACTIVE MICROWAVE SYSTEMS

Unknown, University of Kansas, Lawrence Campus, Graduate School, *214 Strong Hall, Lawrence, Kansas* 66044 (NAS 5-25807)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0015, SELF-CONSISTENT NUMERICAL SIMULATION OF PLASMA-INSULATOR INTERACTIONS IN SPACE

T.P. Armstrong, University of Kansas, Lawrence Campus, School of Liberal Arts & Sciences, Dept. of Physics & Astronomy, *112 Bailey Hall, Lawrence, Kansas* 66045 (NSG 3290)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0016, CONSTRUCTION OF A PROTOTYPE SUPERCONDUCTING GRAVITY GRADIOMETER

H.J. Paik, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NAS 8-33557)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

8.0017, APPLICATION OF MODERN METHODS OF STATISTICAL MECHANICS TO THE PERCOLATION PHENOMENON 15750-P

H.E. Stanley, Boston University, School of Arts & Sciences, Dept. of Physics, *881 Commonwealth Ave., Boston, Massachusetts* 02215 (DA0G8931; DAAG29-79-G-0002)

To develop percolation theory to a level of sophistication that allows its use in a number of Army applications. Relevance - the research is potentially relevant to ongoing work on composites, particularly in areas of graded metal-ceramic armour, airfoil noise reduction, reduction of blast damage and related phenomena. It may prove important to other phenomena such as crack propagation, chemical reactivity, resistance to wear, printed circuit wiring, and phenomena in solid state physics such as semiconductor-metal transitions.

Modern methods of statistical mechanics, such as the renormalization group method and fractural dimensionality, will be used. Equations of state near the percolation threshold will be derived. Six generalizations of the classical percolation problem will be constructed and solved involving correlation, anisotropy, further-than-nearest-neighbors interaction, chains, and site-bond combinations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0018, ANALYSIS OF METAL/SEMICONDUCTOR STRUCTURES BY AUGER AND ELECTRICAL TECHNIQUES

G.Y. Robinson, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Electrical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DMR7614997A01)

This research will be a study of metal/semiconductor contacts using the surface analysis technique of Auger electron spectroscopy combined with conventional electrical characterization techniques. The aim is to develop an understanding about the metallurgical and chemical nature of the metal/semiconductor interface. Research in two areas will be completed during the grant period: (1) studies of the electrical behavior of aluminum-palladium silicide contacts during heat treatment and (2) development of techniques for achieving ohmic contact in the palladium-germanium-gallium arsenide system. Compositional profiling will be done by Auger electron spectroscopy to examine the kinetics of reactions in each of the two systems. A limited number of specimens will also be examined by electron spectroscopy for chemical analysis.

This is a renewal of NSF Grant DMR76-14997.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, OPTICAL HYPERFINE STRUCTURE AND ISOTOPIC SHIFT STUDIES

G.W. Greenlees, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Physics, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (PHY7721737A02)

This grant will support research on fine details of atomic spectra using very high precision laser techniques. These measurements yield information on the electric and magnetic properties of the nuclei of the atoms studied.

These techniques are also highly sensitive allowing measurement on a single atom crossing the laser beam.

The method will be used to study highly unstable nuclei which are produced only in small quantities and decay quickly.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0020, THEORETICAL STUDIES OF SPIN CORRELATION FUNCTIONS

P.A. Fedders, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DMR7706719A01)

A theoretical program of four partially overlapping categories will be carried out: 1. The study of time-dependent spin correlation functions for systems of strongly interacting spins in the high temperature limit. These studies are based on first principles microscopic equations of motion and should elucidate our understanding of dynamical interactions in spin systems. 2. The development and application of a recently discovered formalism for treating the hopping of vacancies, impurities, and interstitial hydrogen in crystal lattices. This formalism is applicable to correlation functions measured in neutron scattering and magnetic resonance experiments in systems where the hopping rates between members of a pair of sites are asymmetric. 3. The further study of the effects of impurities and other crystal defects on measurable spin correlation functions. The proposed work in this category attacks the important problem of how one can quantitatively study crystal defects. 4. The study of basic spin-phonon interactions and their effects on spin lineshapes and on acoustic velocity and attentuation.

This is a continuation of research supported under DMR7518100.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, IMPROPER FERROELECTRICITY - A THEORETICAL AND EXPERIMENTAL STUDY 14221-P

J.R. Hardy, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (DA0E9251; DAAG29 77 G0008)

To elucidate the physical mechanism responsible for the ferroelectric transition in improper ferroelectrics. Relevance - the results of this research explore the mechanism for a new class of materials that have high potential in electro-optic application. GMO acts as an optical switch; its present applicability is limited because of its slow response time. The work is applicable to a broad range of electrooptical materials and as such supports the technological base of nonlinear optics and electro-optical materials.

The program combines a theoretical and experimental program. (1) Theory - the author will consider anharmonic interactions using self-consistent phonon theory to gadolinium molybdate (GMO) in addition to calculation of the lattice dynamics of complex structures like those of other improper ferroelectrics. Some candidate systems are the boracites, dicadmium sulfate and ammonium sulfate. (2) Experimental studies will consist of the measurement of the Raman and far-infrared spectra of these materials as well as a study of the effects of pressure (up to 50 kilobars) and temperature to elucidate mode-Gruneisen parameters.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0022, THE PHYSICS OF SPIN-POLARIZED ATOMIC VAPORS

W. Happer, Columbia University, School of Arts & Sciences, Dept. of Physics, *Broadway & W. 116th St., New York, New York* 10027 (DF038840; AFOSR-74-2685)

AF function - the AF has a requirement for long term, low drift space reference systems. Opportunity - development of optically-pumped frequency standards, magnetometers, and gyroscopes will benefit from study of magnetic resonance in dense vapors where spin exchange equilibrium prevails. Objective - investigation of the properties of high-density, optically-pumped alkali vapors and development of ways to make use of these vapors in miniature, inexpensive devices like magnetometers and gyroscopes. Contribution - cheaper and more rugged navigation, guidance, and control devices.

This research is directed toward development of ways to optically pump a very dense alkali vapor with a laser. Advantages are: the high light flux from the laser will allow much more sensitive and rapid measurements of magnetic resonance frequencies than is feasible with conventional optically-pumped systems or with conventional nuclear magnetic resonance or electron spin resonance techniques, since gallium arsenide injection lasers are very small and potentially very inexpensive; a laser pumped magnetic resonance device can be very small and cheap compared to conventional devices; and the active volume of a device operating in the high density regime can be very much smaller than usual.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0023, NEW SEMICONDUCTOR MATERIALS FOR MICROWAVE DEVICES 14354-EL

J. Frey, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DA0F9118; DAAG29-78-G-0009)

To identify ternary and quaternary III-V compound semiconductors which may be more suitable than GaAs for high-performance microwave devices, such as field-effect transistor (FET's) and transferred-electron devices (TED's). Relevance - microwave devices fabricated from III-V ternary and quaternary materials offer the possibility of extending the frequency-of-operation, increasing the available power and gain, and decreasing the noise over existing GaAs devices. Such devices would impact Army communications/navigation systems in tactical, satellite, and missile guidance applications.

The Monte Carlo method will be used to study the steady-state and transient high-field transport properties of III-V ternary and quaternary semiconductors. Material parameters will be obtained from an interpolation procedure which uses known material parameters for the binary compounds of which the ternary and quaternary materials are composed. This technique will generate fundamental transport parameters which will then be used in device models to predict figures-of-merit for FET's and TED's. The fundamental gain, power, frequency response, and noise-determining mechanisms will be studied.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0024, THEORY OF ORBITAL EFFECTS IN RARE-EARTH COMPOUNDS

P.M. Levy, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (DMR7825008)

Research previously supported in part by DMR7682363.

Theoretical and experimental research will be carried out on a number of properties of a particularly interesting class of metallic compounds, viz. the rare-earth pnictides. The unusual properties of these compounds are due to the large orbital contribution to the magnetic moments of the rare earths, which complicates the interaction between the rare earth and conduction electrons. The effects on the magneto-transport properties of the spin-orbit coupling of the 5D electrons will be calculated. To obtain more realistic estimates of the anisotrophy of the magnetoresistivity of cubic rare-earth compounds due to scattering of the conduction electrons, a variational form of the resistivity will be used. To complement the theoretical work, an experimental study of the anisotropic electrical resistivity of the rare-earth pnictides is planned. These measurements will provide data on the background anisotropy coming from the band structure. To determine the hyperfine field at rare-earth nuclei in metallic compounds, the field coming from the orbital polarization of the conduction electrons by the electrons will be calculated.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, FREE-ELECTRON LASER FROM WAVE MECHANICAL BEATS OF TWO ELECTRON BEAMS

H.J. Schwarz, Rensselaer Polytechnic Inst., School of Science, Dept. of Physics, *110 8th, Troy, New York* 12181 (NSG 1628)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0026, COMBUSTION THEORY FOR CLOUDS OF POROUS SOLIDS AT REDUCED GRAVITATIONAL CONDITIONS

A. Berlad, State University of New York, Stony Brook Campus, School of Engineering & Applied Science, Dept. of Mechanics, *Stony Brook, New York* 11794 (NSG 3298)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0027, NEUTRON SCATTERING STUDIES

L. Corliss, U.S. Dept. of Energy, Brookhaven National Lab., *Upton, New York* 11973

The following subjects are being investigated: neutron scattering measurements to obtain structural and dynamic properties of solids; magnetic systems; spatial distribution of magnetization, its response to applied fields, and behavior of spontaneous magnetic fluctuations; complete characterization of the magnetic ordered and disordered states as well as the interesting critical region in the neighborhood of the ordering transition; arrangement of atoms and dynamics of motion of nonmagnetic solids. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0028, EXPERIMENTAL RESEARCH - SURFACE STUDIES

M. Strongin, U.S. Dept. of Energy, Brookhaven National Lab., *Upton, New York* 11973

The following subjects are being investigated: use of AC pulsing techniques under ultrahigh vacuum conditions to study chemical reactions such as the oxidation of CO on the surfaces of single-crystal and polycrystalline Group VIII metals (Pt, Pd, Rh, Ru, etc.) and transition metal oxides; understanding and development of secondary ion mass spectroscopy for chemisorption studies; correlation with chemisorption bonds and surface phases; and interaction of low-energy ions with surfaces. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0029, LIQUID HELIUM AT LOW TEMPERATURES

D.O. Edwards, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave.*, Columbus, Ohio 43210 (DMR7901073)

This research is a continuation and extension of work supported under NSF Grant No. DMR-7519546. Experiments to study the free surface of liquid helium will be carried out at temperatures down to 0.02K using a dilution refrigerator. The measurements will include the conduction of heat along the surface by quantized capillary waves, the scattering of free helium atoms, and the heat capacity of helium-3 atoms adsorbed on the surface of superfluid helium-4. The superfluid properties of helium-3 at ultra-low temperatures (down to 0.0004K) will be studied using a nuclear demagnetization cryostat. The experiments will include measurements of the heat capacity of the A and B superfluid phases and of the normal liquid in zero magnetic field, of the superfluid phase diagram and the nuclear magnetization in fields up to 6 kilogauss. The same apparatus will also be used to study nuclear spin ordering in solids helium-3.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, FLUX PINNING AND FLUX FLOW STUDIES IN SUPERCONDUCTORS USING FLUX FLOW NOISE TECHNIQUES

W.C. Joiner, University of Cincinnati, McMicken College of Arts & Sciences, Dept. of Physics, *Van Wormer Adm. Bldg., Room 204*, Cincinnati, Ohio 45221

The objective of this work is to study flux pinning and the dynamics of flux flow in type-II superconductors. Superconducting alloy samples will be prepared containing various metallurgical defects and exhibiting different critical current characteristics resulting from the defect structure, and the flux flow noise power spectrum will be studied. This gives information on flux bundle size, transit time, pinning forces, and other flux flow parameters. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0031, THEORETICAL STUDIES OF NUCLEAR STRUCTURE AND NUCLEAR REACTIONS

N. Austern, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY7681104A02)

Theoretical research on nuclear structure and reactions and related studies of medium-energy meson-nucleus processes and of multiple scattering theory initiated under NSF grant PHY75-01397 A01 will be continued.

The nuclear structure work emphasizes a large-scale study of properties of the shell-model effective interaction, derived by the systematic selection of a limited part of Hilbert space. Careful study is given to the singularities of this effective interaction. Techniques for overcoming these singularities and for other improvements to the effective interaction are being developed.

A vigorous program in 'medium-energy nuclear physics' will be continued. Computer codes developed for meson-nucleus collision studies have been improved and generalized so they can be used more conveniently at Pittsburgh and made available to others. Applications to kaon scattering are under way, as are studies of mesic atoms and of pion photoproduction and capture. Much of this work is in collaboration with experimental groups at Carnegie-Mellon University and at LAMPF. Other medium-energy work concerns fundamentals of multiple scattering theory, with particular attention to corrections to closure and to the impulse approximation.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0032, THEORETICAL ATOMIC PHYSICS

R.L. Becker, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (AK-01-03-01-3; W7405-eng-26)

Initiated as a separate project in FY-78 this activity aims to perform calculations and develop theories for important atomic processes, primarily those under experimental investigation at ORNL, with emphasis on cross-sections and spectroscopy useful to the magnetic fusion energy and heavy-ion accelerator programs. At present effort is concentrated on calculating charge exchange and ionization produced by energetic highly stripped ions colliding with atomic hydrogen, which are being measured at ORNL and are important as energy-loss mechanisms resulting from impurities in plasmas. Also the capability to compute spectra of multi-charged ions is being developed for use in the diagnostics and modeling of plasmas. Consulting and collaboration with experimentalists is an important activity expected to increase as theoretical tools are developed. Participation by university theorists will be encouraged strongly. (ORNL/CF-78/111)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0033, INVESTIGATIONS IN X-RADIATION STIMULATION

K. DasGupta, Texas Tech University, School of Arts & Sciences, Dept. of Physics, *P.O. Box 4340, Lubbock, Texas* 79409 (DF035070; AFOSR-76-3098)

AF function - non-destructive testing of structural members of aerospace vehicles could benefit greatly from the development of an X-ray laser for use in three-dimensional holography. Deficiency - attempts to develop an X-ray laser by standard population inversion techniques have been unsuccessful primarily because of short life-times of excited states. Objective - the objective of this research is to investigate the nature of nearly non-divergent beams of X-rays (hot spots) which apparently are generated by hitherto undiscovered processes and to use this

radiation to make three-dimensional holograms of opaque materials. How work contributes - an understanding of the nature of these hot spots could lead to or contribute to the development of X-ray lasers and three-dimensional holography could lead to important non-destructive testing techniques for structural materials.

The nearly non-divergent beams of X-rays will be studied to determine their penetration properties in various materials, role of stimulated emission, and the degree of coherence and polarization. Three-dimensional holograms will be made in collaboration with Prof. N. George of the University of Rochester.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0034, INVESTIGATION OF THE INITIATION OF SOLID STATE STRUCTURAL PHASE TRANSFORMATIONS AT CRYSTAL SURFACES BY LOW-ENERGY ELECTRON DIFFRACTION

A. Ignatiev, University of Houston, School of Arts & Sciences, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DA0K5574; DAAG29 77 G0162)

To investigate the initiation at surfaces of structural phase transformations of the non-diffusional Martensitic type in solids. Relevance - the proposed research is highly relevant to the technologically important Martensitic phase transformation and its control is responsible for strengthening the steels used by the Army, for control of fragmentation, fatigue, stress corrosion cracking, etc. The study is directly relevant to programs at AMMRC involving phase transformations in metals.

The program will include (1) determination of virbrational properties and crystallographic spacing of surface atoms during Martensitic phase transformations using low energy electron diffraction, and (2) interpretation of vibration of surface atoms in terms of the theory that high amplitude (soft mode) vibration lowers the barrier to nucleation of non-diffusional Martensitic transformations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0035, EXPERIMENTAL STUDY OF THE INITIAL PHASES OF A TOKAMAK DISCHARGE

R.D. Bengtson, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712

This experimental study will be conducted in a research Tokamak with design parameters R equals 53 cm, a equals 16 cm, B equals 10 to 20 KG, I/sub p/ equals 80 to 160 KA, T/sub e/ equals 400 eV, usable pulse length 50 msi. Emphasis will be placed on impurity transport and atomic physics studies of discharge initiation by a variety of techniques. Diagnostics to be installed on the device include 2 and 4 mm microwave Thompson scattering, and a wide variety of spectrometers.

SUPPORTED BY U.S. Dept. of Energy

8.0036, COMPTON SCATTERINGS OF METAL HYDRIDES WITH 412 KEFY - RADIATION

M.J. Cooper, University of Warwick, Dept. of Physics, *Coventry, England, United Kingdom* (DA0D9371; DAERO 78 G0019)

An Au 198 gamma ray source is constructed at Rutherford Laboratory. Dr. J. L. Dubard of the U.S.A. is experienced with similar sources and is to spend a sabbatical year in the U.K. assisting in this Au 198 source. The research itself will center around the sensitivity of the Compton profile to the behavior of hydrogen in metals. The electron momentum density of metals, and particularly metal hydrides, will be measured.

It is anticipated that by using the Au 198 source, two orders of magnitude improvement will be achieved.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, FOREIGN LABOR AND CAPITAL COSTS FOR THE MANUFACTURE OF BALANCE OF SYSTEM COMPONENTS

J.E. Jacobson, Georgia Inst. of Technology, Graduate School, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NSG 3297)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, LABORATORY INVESTIGATION OF THE ORIGIN OF DIFFUSE INTERSTELLAR BANDS

T.J. Wdowiak, Miles College, Undergraduate School, *5500 Ave. G, Birmingham, Alabama* 35208 (RIM78-17825)

The research that will be done is to elucidate the origin of the diffuse interstellar bands by subjecting fused ring organic compounds to temperatures in the range of 10 degrees to 100 degrees K and to ultraviolet radiation. The samples will be examined by absorption spectroscopy. Molecular structures to be investigated will include graphite precursor molecules and conjugated linear molecules thought to be good candidates for the constituents of interstellar dust. A free radical, free electron model fits many of the characteristics of diffuse interstellar bands and will be used as the rationale for the experiments.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, STUDIES OF WHITE DWARF STARS

J.W. Liebert, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (AST7821071)

This project will be devoted to an investigation of the origin and properties of white dwarf stars and pre-white dwarf star evolution. White dwarf stars represent one of the end points of stellar evolution. They are stars of about one solar mass, with radii of about 5,000 kilometers and densities of one ton per cubic centimeter. The research to be carried out on these stars will include detailed analyses based on optical spectrophotometry of hot white dwarf stars. There will be a theoretical investigation of the manner in which stars become white dwarfs.

It is now generally believed that nova take place in binary systems which contain a white dwarf star. The nova occurs when mass is transferred from the companion star onto the white dwarf star. There will be theoretical and observational studies of white dwarf stars in binary stars, with particular attention directed towards the properties of the classical novae, the formation of dust in nova shells, and nova-like variables.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, THERMAL BEHAVIOR OF MARTIAN SATELLITES PHOBOS AND DEIMOS

C.H. Townes, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (NSG 7635)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0004, GAS IN GALAXIES - ASTROPHYSICAL GAS DYNAMICS

W.G. Mathews, University of California, Santa Cruz Campus, Lick Observatory, *Mount Hamilton, California* 95140 (AST7818220)

Locally, in our own galaxy stars represent the most apparent form of condensed matter. Many of these stars are as old as the galaxy itself. New stars are continuously being formed from rarefield clouds of interstellar matter. Old stars are observed to throw off a significant part of their outer envelopes back into the pool of interstellar gas, enriched with elements produced by nuclear processes within these stars. Studies of the gaseous component of our galaxy have been scientifically fruitful as the gas responds to additional and more subtle forces than of gravity alone, which is the major force acting on the stellar component. Observational and theoretical studies of tenuous gas near stars has revealed the presence of stellar winds similar to the wind from the sun.

In the central nucleus of quasi-stellar (QSOs) and certain remarkable galaxies, the Seyfert galaxies, an enormous energy powerhouse exists which strongly influences the motion of nearby gas.

At present we know very little about exactly how this energy is released, but giant black holes may be responsible for the energy released. Black holes are not directly observed, but violent motions in nearby gas are easily observed. A careful theoretical study of this gaseous component may reveal more about how energy is released at rates unparalleled elsewhere in the known universe.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, DEDUCTION OF IMPULSE SIGNAL FROM THE RESPONSE FUNCTION IN THE IONOSPHERE
W.A. Barker, University of Santa Clara, School of Science, Dept. of Physics, *El Camino Rd., Santa Clara, California 95053 (NCA 2-685909)*

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0006, EFFECTS OF TURBULENCE ON IMAGE QUALITY IN AIRBORNE TELESCOPES
G.A. Fraser, University of Santa Clara, School of Science, Dept. of Mathematics, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685908)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0007, ACCURACY OF GRAVITATIONAL PHYSICS TESTS USING RANGES TO THE INNER PLANETS
N. Ashby, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (NSG 7637)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0008, RADIATION TRANSPORT IN SPACE
M.J. Berger, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (2401430)

PROJECT OBJECTIVE: To solve radiation metrology problems arising in space science and technology. To determine response functions of gamma ray and charged particle detectors, and to use them for converting observed pulse height distributions to energy spectra. Application of these techniques to the analysis of data obtained in space experiments.

PROJECT APPROACH: Research involves modeling of detection systems, calculation of energy deposition in detectors by random sampling, to obtain detector response functions. Important additional phase of work involves reconstruction of energy spectra from gamma and charged particle radiation, taking into account response function as well as removal of distortion and background.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

10.0009, OBSERVATIONS OF ULTRAVIOLET LINE SPECTRA STARS
R.A. Bell, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NSG 5399)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0010, STELLAR PHYSICS - SOLAR OBSERVATIONS
R.W. Noyes, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138

This project is an ongoing one, which includes both satellite and ground-based observations. Satellite observations were obtained in 1967 and 1969 from the Orbiting Solar Observatories *OSO 4 and OSO 6, by means of extreme ultraviolet spectrometers* built by the Harvard College Observatory Solar Satellite Project. The data have opened up a new spectral region to detailed physical analysis and will continue for several years to provide fundamental information on the physics of the solar corona.

In a related program of ground-based observations, the structure of the solar atmosphere near its temperature minimum is being explored, by use of high-resolution infrared (5 micron) *spectra of the sun obtained at Kitt Peak National Observatory.* These data are being analyzed using an SAO stellar atmospheres program and should provide definitive information on the solar temperature minimum. At the same time, the structure of sunspots is being studied with the same observing equipment.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0011, ASTRONOMY RESEARCH AT THE FIVE COLLEGE RADIO ASTRONOMY OBSERVATORY
G.R. Huguenin, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Amherst, Massachusetts* 01002 (AST7624610A03)

The Five College Radio Astronomy Observatory will pursue three major projects: 1. The very successful program of pulsar observation will be continued. The behavior of pulsars and their motion through space will be determined in an attempt to characterize the emission mechanism, the rate of formation and other attributes of these unusual, highly condensed objects. The meter wave array used for these observations will be enlarged in order to improve the sensitivity and increase the number of observable objects. 2. The 45-foot, radome enclosed, millimeter telescope will be used for studies of the interstellar medium, extragalactic radio sources, and solar system objects.

Development will continue on the application of very low noise maser amplifiers for radio astronomy at millimeter wavelengths. As such receivers become available, they will be put into use on the telescope where it is expected they will provide a ten to fifty-fold increase in sensitivity.

This is a continuation of work previously supported under NSF Grant AST 76-24610.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0012, OBSERVATIONS OF EMISSION LINES IN THE CRAB NEBULA
K. Davidson, University of Minnesota, Minneapolis Campus, Inst. of Technology, Dept. of Astronomy, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (NSG 5397)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0013, RESEARCH STUDY - ANALYSIS OF SPACE TELESCOPE COLLECTION SYSTEMS
F.M. Ingels, Mississippi State University, School of Engineering, Dept. of Electrical Engineering, *Suite 101 Engineering Bldg., Mississippi State, Mississippi* 39762 (NAS 8-33570)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

10.0014, RESEARCH OF MASS LOSS IN THE ULTRAVIOLET SPECTRUM
S.A. Lamb, University of Missouri, St. Louis Campus, Graduate School, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (NSG 5400)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0015, GALACTIC AND EXTRAGALACTIC RESEARCH WITH THE IMPROVED BURRELL SCHMIDT-TYPE TELESCOPE
P. Pesch, Case Western Reserve University, Graduate School, Dept. of Astronomy, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (AST7723063A01)

A variety of astronomy research projects will be undertaken by the staff of the Warner and Swasey Observatory. The projects will include studies of faint nearby stars, luminous stars in the Milky Way Galaxy, and Quasars. The common theme of the projects is the unique capability of a Schmidt telescope equipped with objective-prisms to do faint spectroscopy and surveys of astronomical objects.

One of the new projects is a low-dispersion (1000 A/mm at 6500A) survey of the northern sky in the red region of the spectrum. This survey, to update one last done in the early 1940's at very low resolution, will identify nearby M-type dwarfs, sulfur and carbon-sulfur stars, and objects that emit the hydrogen-alpha lines of the spectrum.

Another new project is a color-independent survey in the northern sky for bright, high-redshift, radio-quiet, quasi-stellar objects (QSO's). Malcolm Smith at Cerro Tololo Inter-American Observatory has shown that a low-dispersion objective-prism can be used to discover high-redshift QSO's independent of color and/or radio characteristics. A survey of this nature is being done by others in the southern hemisphere; a similar survey in the northern sky will be initiated. This is the only known method of obtaining an accurate and unbiased sample of these cosmologically important objects. The continuing projects will include an effort aimed at identification of objects listed in the Air Force Infrared Sky Survey Catalogue. The photoelectric photometry of faint M stars in the direction of both the north and the south galactic poles will be obtained for purposes of determining correctly the space of dwarf M stars. Objective-prism spectral classification of parallax stars, studies of the Magellanic Clouds, and an investigation of radial velocities of stars obtained from Schmidt telescope objective-prism plates will be carried out. This is a continuation of research done under NSF grant AST 77-23063.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0016, SPECTRUM OF THE CONTINUOUS GRAVITATIONAL RADIATION BACKGROUND
R.L. Zimmerman, Oregon State Higher Education System, University of Oregon, Inst. of Theoretical Science, *Johnson Hall, Eugene, Oregon* 97403 (NSG 7639)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0017, SPECTRAL ANALYSIS OF GALACTIC AND EXTRAGALACTIC SUPERNOVA REMNANTS
R.J. Dufour, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (NAS 9-15940)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Johnson Space Center

10.0018, INTERPRETATION OF SURVEY WORK OF SUPERNOVA SHOCKS, BUBBLES AND STUDYING VARIABILITY OF ACTIVE GALAXIES
M. Kafatos, George Mason University, School of Arts & Sciences, Dept. of Astronomy, *400 University Dr., Fairfax, Virginia* 22030 (NSG 5403)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0019, ULTRAVIOLET OBSERVATIONS OF SELECTED CATACLYSMIC VARIABLES
P. Szkody, University of Washington, Graduate School, *Seattle, Washington* 98105 (NSG 5395)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0020, OBSERVATIONS OF CLASSICAL STELLAR CHROMOSPHERES
E. Bohm Vitense, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (NSG 5398)

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GENERAL

11.0001, TO CONDUCT RESEARCH ON THE EFFECTIVENESS OF GOVERNMENT SPONSORED CIVILIAN RESEARCH AND DEVELOPMENT
H.I. Fusfeld, New York University, Graduate School, *100 Washington Sq. E., New York, New York* 10003 (NSG 7636)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

11.0002, LECTURE SERIES - 'OUR FUTURE IN THE COSMOS'
C.H. Barnes, College of William & Mary, Williamsburg College, Graduate School, *Ewell Hall, Williamsburg, Virginia* 23185 (NAS 1-15899)

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01 AERONAUTICS (GENERAL)

N80-11002 Allerton Press, Inc., New York, N. Y.
SOVIET AERONAUTICS, VOLUME 21, NO. 2
A. V. Talantov, ed., A. I. Bogomolov, ed., B. S. Vinogradov, ed., and A. F. Gurov, ed. 1978 130 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 5-146
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The aerodynamics of aircraft structures and engine design are considered. Emphasis is placed on the application of numerical analysis techniques and mathematics to such problems. For individual titles, see N80-11003 through N80-11027.

N80-11003 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL STUDY OF SHELL STABILITY UNDER HEATING AND LOADING c39
V. K. Belov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 1-3 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 5-8 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press Inc., 150 Fifth Ave., N.Y. 10011; $45.00

The stability of cylindrical shells partially filled with liquid when heated and subjected to combined loading by axial compression and internal pressure is studied. The experimental results are compared with the theoretical data. J.M.S.

N80-11004 Allerton Press, Inc., New York, N. Y.
ON SOLUTION OF THE PLANE PROBLEM OF REINFORCED PANELS OF VARIABLE STIFFNESS c39
M. B. Vakhitov, V. N. Paimushin, and N. M. Yakupov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 4-9 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 9-16 (For primary document see N80-11002 02-01)
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An approximate approach is proposed for the solution of the problem of the plane stress state of structurally anisotropic panels of variable stiffness and complex planform. Assuming linear variation of the displacement vectors between the computational lines, specified in equation form, the governing system of ordinary difference-differential equations is obtained. The numerical solution of these equations for a panel with three free edges and one clamped edge is examined. Results are presented of calculations for particular cases and they are compared with the solutions available in the literature. J.M.S.

N80-11005 Allerton Press, Inc., New York, N. Y.
SURFACE-EFFECT COMPONENTS OF AERODYNAMIC CHARACTERISTICS OF AIR-CUSHION VEHICLE WITH RAM PRESSURIZATION c02
M. A. Guryanov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 10-19 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 17-29 (For primary document see N80-11002 02-01)
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Results are presented of theoretical studies of the purely surface-effect components of the aerodynamic characteristics of an air-cushion vehicle consisting of a semitunnel of pi-shaped cross section traveling above a ground plane with translational velocity. A solution establishing the connection between these characteristics and the basic parameters defining the geometric form of the semitunnel and its position relative to the ground plane is obtained. It is shown that the studied vehicle has high aerodynamic efficiency and natural stability with respect to running height and pitch angle, particularly in the region of low semitunnel aspect ratios. Use of the proposed analysis method together with the known methods for determining the aerodynamic characteristics of flight vehicles in out-of-ground-effect flight makes it possible to calculate and optimize in the first approximation the aerodynamic characteristics of surface-effect vehicles and air-cushion aerotrains with ram pressurization. J.M.S.

N80-11006 Allerton Press, Inc., New York, N. Y.
STATISTICAL DIAGNOSTICS AIRCRAFT ENGINES c07
Yu. V. Kozhevnikov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 20-25 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 30-35 (For primary document see N80-11002 02-01)
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The linear formulation of the statistical problem for engine parametric diagnostics is examined in a discrete system of steady-state aircraft engine operating regimes. F.O.S.

N80-11007 Allerton Press, Inc., New York, N. Y.
OPTIMAL THERMOGASDYNAMIC DESIGN OF GAS TURBINE ENGINES USING ELEMENT PROTOTYPES, 1 c07
Yu. V. Kozhevnikov, V. O. Borovik, V. S. Ivanov, V. A. Talyzin, I. N. Agliullin, and Yu. V. Moluzov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 26-32 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 36-43 (For primary document see N80-11002 02-01)
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The problem of optimal thermogasdynamic design of gas turbine engines (GTE) is examined on the basis of a systematic mathematical model of a two-spool bypass GTE, containing the characteristics of the engine element prototypes in similarity parameters. The multiregime nature of GTE application is considered in the statistical formulation. Some GTE design parameter optimization criteria are presented. J.M.S.

N80-11008 Allerton Press, Inc., New York, N. Y.
AERODYNAMIC HEATING OF BLUNT WEDGES c02
N. M. Krutova, T. I. Murashina, and G. B. Petrazhitskii *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 33-36 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR),

v. 21, no. 2, 1978 p 44-48 (For primary document see N80-11002 02-01)
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A numerical method was used to solve the two dimensional problem of unsteady heat conduction. The temperature distribution over the surface of a blunt wedge was determined for various physical properties of the body material. R.E.S.

N80-11009 Allerton Press, Inc., New York, N. Y.
SELECTION OF GEOMETRIC PARAMETERS AND LOCATION OF NOSE FLAP ON SWEPT WING ROOT PROFILE FROM TUNNEL TEST DATA, 1 c02
A. I. Matyash, V. A. Sterlin, V. A. Popov, V. V. Isaev, and G. A. Cheremukhin *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 37-41 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 49-54 (For primary document see N80-11002 02-01)
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The influence of nose flap geometric parameters (curvature and location on profile nose) on the basic aerodynamic coefficients of a mechanized wing segment whose profile corresponds to the typical profile used on swept wings of civil aircraft were examined. Recommendations are made on selection of the curvature and location of a nose flap used in conjunction with a two element slotted trailing-edge flap. R.E.S.

N80-11010 Allerton Press, Inc., New York, N. Y.
ANALYTIC FORMULAS FOR WING PROFILE AERODYNAMIC CHARACTERISTICS IN INCOMPRESSIBLE FLOW c02
N. M. Monakhov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 42-47 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 55-61 (For primary document see N80-11002 02-01)
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The conformal mapping method was used to construct in the third approximation the equations for determining the abscissa of the conformal center of gravity of a profile, the mapping circle radius, and the points of the circle corresponding to the profile leading and trailing edges. Analytic formulas for the lift and moment coefficients, aerodynamic center and center of pressure coordinates, and profile surface velocity were obtained with accuracy to quantities of fourth order of smallness. An example (cambered lune) calculation shows that the proposed formulas have very high accuracy. R.E.S.

N80-11011 Allerton Press, Inc., New York, N. Y.
ON A SMOOTH APPROXIMATION METHOD AND ITS APPLICATION TO MATHEMATICAL DESCRIPTION OF WING AERODYNAMIC CHARACTERISTICS c02
V. A. Ovchinnikov, V. D. Osorgin, V. G. Pavlov, and E. Ya. Fedorov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 48-51 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 62-65 (For primary document see N80-11002 02-01)
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A method for smooth epsilon approximation of a function of many variables with discontinuities of the first order derivatives at the points of some hypersurface is presented. The method makes it possible to represent any function, specified in the region of smoothness by suitable relations, in the form of a differentiable envelope lying in the epsilon vicinity of the original function. An example is given of specification of the aerodynamic characteristics of a wing with two element trailing-edge flap by the envelope. It is shown that the definition of the function epsilon introduced herein makes it possible with existing limits on its magnitude to obtain an approximation accuracy which is adequate for practical calculations. R.E.S.

N80-11012 Allerton Press, Inc., New York, N. Y.
INFLUENCE OF WING DEFORMATION ON TRAILING-EDGE FLAP DEFLECTIONS c02
V. A. Pavlov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 52-53 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 66-67 (For primary document see N80-11002 02-01)
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The interaction of a three hinge trailing-edge flap with a wing is described. The influence of wing bending deformations on displacements of the flap carriages along the rails is also described. An analogy between trailing-edge flap analysis and multihinge control surface analysis is presented. Analysis procedures for various flap extension and retraction mechanism locations are examined. R.E.S.

N80-11013 Allerton Press, Inc., New York, N. Y.
SOLUTION OF THE INVERSE AERODYNAMICS PROBLEM BY THE RANDOM SEARCH METHOD c02
G. D. Peshatov and Yu. N. Novoselov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 54-58 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 68-73 (For primary document see N80-11002 02-01)
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A technique for computer design of a wing profile contour for a given pressure distribution is examined. A mathematical method for constructing the singly connected closed contour with limitations specified on its form is presented. The method can be used for computer design of subsonic and supersonic profiles in the automatic regime. A brief description of the optimization algorithm used and its block diagram are given. Results are presented of a test computer design of the aerodynamic profile for a given experimental pressure distribution. R.E.S.

N80-11014 Allerton Press, Inc., New York, N. Y.
ANALYTIC DESIGN OF COMPLEX SYSTEMS, 1 c66
T. K. Sirazetdinov and A. I. Bogomolov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 67-73 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 83-91 (For primary document see N80-11002 02-01)
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The fundamental questions of the control and design of multicriterial and multiregime systems (complex systems) are discussed. It was concluded that for such systems the approach to control and design from the viewpoint of the basic control problem is the best engineering practice. M.M.M.

N80-11015 Allerton Press, Inc., New York, N. Y.
ON THE LIMIT STATE OF A TOROIDAL SHELL OF REVOLUTION UNDER AXISYMMETRIC DEFORMATION c39
I. G. Teregulov and E. S. Sibgatullin *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 74-77 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 92-96 (For primary document see N80-11002 02-01)
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The lower failure load bound for a shell supported clamped along one of the parallels was determined. The shell is partially filled with liquid and subjected to the action of uniform internal pressure. The solution is constructed by the static method and the simplex linear programming method is used. M.M.M.

N80-11016 Allerton Press, Inc., New York, N. Y.
OPTIMAL OBJECT CONTROL WITH WORST RANDOM PARAMETER DISTRIBUTION c63
V. I. Timofeev and S. M. Chernyavskii *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 78-83 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 97-103 (For primary document see N80-11002 02-01)
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The optimal control is presented for the problem of minimizing the mathematical expectation of the norm of the final state of the linear controllable system under conditions of incomplete information on the statistical characteristics of the random quantities appearing in the system. It was concluded that the statistic characteristics are not specified exactly, only the set of

their allowable values is known. The optimal control is found for the worst distribution of the characteristics of the random quantities. The results obtained makes it possible to reduce the original problem to the classical maximum problem. M.M.M.

N80-11017 Allerton Press, Inc., New York, N. Y.
LOAD-CARRYING ABILITY OF CYLINDRICAL SHELL LOADED BY CONCENTRATED FORCE ACTING ALONG THE GENERATOR c39
A. M. Khomyakov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 84-87 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 104-107 (For primary document see N80-11002 02-01)
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The critical concentrated force was evaluated on the basis of analysis of a variant of the plane stress state of the shell material near the given loading area. Two variants of a certain combination of slip lines were examined around the area and the corresponding computational formulas were derived for the limit force. An approximate grapho-analytic technique is presented for determining the limit force, valid in a broad range of values of the stress state components in the shell. The proposed technique can be used to evaluate the load-carrying ability of correspondingly loaded shell-type structures. M.M.M.

N80-11018 Allerton Press, Inc., New York, N. Y.
NUMERICAL INTEGRATION OF EQUATIONS OF THEORY OF THIN-WALL BEAMS WITH DEFORMABLE CONTOUR c39
V. Shataev *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 88-92 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 108-114 (For primary document see N80-11002 02-01)
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The stress-strain state of cylindrical stiffened beams with deformable cross-section contour are presented. The skin works only in shear, the stiffening ribs work in tension-compression. The normal diaphragms are smeared over the length of the structure. The structure is broken down into bays in order to account for the heavy diaphragms. Matrix equations are obtained for numerical solution of the problem by the finite sum method. M.M.M.

N80-11019 Allerton Press, Inc., New York, N. Y.
HARMONIC OSCILLATIONS OF ANNULAR WING IN STEADY IDEAL FLUID FLOW c02
Z. N. Shesternina *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 93-98 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 115-121 (For primary document see N80-11002 02-01)
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A method is presented to solve the problem of the annular wing with thick profile, performing small harmonic oscillations in ideal incompressible fluid flow. Two cases are examined: axisymmetric flow with oscillations along the axis of symmetry; and flow with periodically varying small angle of attack. M.M.M.

N80-11020 Allerton Press, Inc., New York, N. Y.
ANALYTIC DESIGN OF REGULATORS FOR VARIABLE-PARAMETER SYSTEMS c66
A. A. Baloev *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 99-102 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 122-126 (For primary document see N80-11002 02-01)
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Formulas are obtained which make it possible to calculate the coefficients of the sought control law for known particular solutions of the variational problem equations to reduce computer time. M.M.M.

N80-11021 Allerton Press, Inc., New York, N. Y.
ON THE DAMPING EFFECT IN SURFACE PLASTIC DEFORMATION c31
P. G. Balyura *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 103-106 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 126-129 (For primary document see N80-11002 02-01)
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Vibration theory is used to examine two techniques for metal working by surface plastic deformation which are schematized by two mechanical models. It is shown that in the second metal working technique the indentor vibrations can be minimized by reducing its period and amplitude. Oscillographic studies and the obtained quantitative data confirm the advisability of using the second technique for metal working under production conditions. K.L.

N80-11022 Allerton Press, Inc., New York, N. Y.
OVERALL AERODYNAMIC CHARACTERISTICS OF CARET AND DELTA WINGS AT SUPERSONIC SPEEDS c02
Yu P. Gunko and I. I. Mazhul *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 107-110 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 129-132 (For primary document see N80-11002 02-01)
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The influence of caret angle, design Mach number, and free stream Mach number on the aerodynamic characteristics of caret wings are studied experimentally and theoretically. Caret wings and their equivalent delta wings are compared in the class with constant volume coefficient and aspect ratio. The results obtained relate basically to the flow regimes around caret wings with free stream Mach number less than design Mach number. K.L.

N80-11023 Allerton Press, Inc., New York, N. Y.
DETERMINATION OF LOADS AND STRESS IN COMPOSITE MATERIAL LAYERS FOR A PLATE IN THE PLANE STRESS STATE c39
A. A. Dudcheriko and A. N. Elpatevskii *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 111-113 ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 132-135 (For primary document see N80-11002 02-01)
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A method is described for determining the loads and stresses in the layers of an anisotropic plate using the least work principle. The secondary energy is written in terms of forces whose direction coincides with the fiber placement direction. It is shown that addition to the packet of each new layer of a definite direction above the three existing layers increases the degree of static indeterminacy of the plane problem by one. K.L.

N80-11024 Allerton Press, Inc., New York, N. Y.
SELECTING THE PASSENGER AIRPLANE FUSELAGE c05
Yu. N. Egorov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 114-116 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 135-138 (For primary document see N80-11002 02-01)
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The problem of selecting fuselage parameters is examined. A simple approach allows early selection of fundamental regions of goodness for a particular fuselage as a function of its passenger capacity. K.L.

N80-11025 Allerton Press, Inc., New York, N. Y.
INFLUENCE OF CONTOUR DEFORMATION IN PREBUCKLING STATE ON BENDING STABILITY OF OPEN CYLINDRICAL SHELLS c39
S. N. Kan, Yu. I. Kaplan, and N. V. Panova *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 117-119 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 138-141 (For primary document see N80-11002 02-01)
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The influence of contour deformation on bending moments was studied by successive approximation to determine the critical moment for bending. It was found that bending occurs before

the limit point. This must be considered in analyzing the loading of cylindrical shells. K.L.

N80-11026 Allerton Press, Inc., New York, N. Y.
MIXED INVERSE PROBLEM FOR PROFILE WITH GIVEN VELOCITY DISTRIBUTION ON ONE SIDE AND KNOWN THICKNESS LAW c02
S. D. Kostomoi and A. A. Litvinenko *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 120-122 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 142-144 (For primary document see N80-11002 02-01)
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The formulation and solution of the mixed inverse problem is examined for a profile contour in a plan-parallel ideal incompressible fluid stream when the profile thickness distribution and the flow velocity distribution on one side of the profile are given. Application of the vortex layer method reduces the problem to a system of two integrodifferential equations for one side of the profile. A successive approximation method is proposed for solution of the resulting system of integrodifferential equations. Results of numerical calculations are presented. K.L.

N80-11027 Allerton Press, Inc., New York, N. Y.
ON FREE PERIODIC PARACHUTE SYSTEM OSCILLATIONS IN THE AXIAL PLANE c02
V. M. Churkin and N. A. Kosarchuk *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 144-146 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 144-146 (For primary document see N80-11002 02-01)
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The harmonic linearization method is used to analyze the free periodic oscillations of a parachute system as it travels in the axial plane with zero glide angle. It is shown that such oscillations are always stable and their amplitude and frequency are determined. Author

N80-11028*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF A WIND-TUNNEL GUST RESPONSE TECHNIQUE INCLUDING CORRELATIONS WITH ANALYTICAL AND FLIGHT TEST RESULTS
L. Tracy Redd, Perry W. Hanson, and Eleanor C. Wynne Nov. 1979 55 p refs
(NASA-TP-1501; L-1313) Avail: NTIS HC A04/MF A01 CSCL 01A

A wind tunnel technique for obtaining gust frequency response functions for use in predicting the response of flexible aircraft to atmospheric turbulence is evaluated. The tunnel test results for a dynamically scaled cable supported aeroelastic model are compared with analytical and flight data. The wind tunnel technique, which employs oscillating vanes in the tunnel throat section to generate a sinusoidally varying flow field around the model, was evaluated by use of a 1/30 scale model of the B-52E airplane. Correlation between the wind tunnel results, flight test results, and analytical predictions for response in the short period and wing first elastic modes of motion are presented. A.W.H.

N80-11029*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUPERSONIC CRUISE RESEARCH (SCR) PROGRAM PUBLICATIONS FOR FISCAL YEAR 1977 THROUGH FISCAL YEAR 1979: PRELIMINARY BIBLIOGRAPHY
S. Hoffman Nov. 1979 43 p
(NASA-TM-80184; P3110) Avail: NTIS HC A03/MF A01 CSCL 01B

Approximately 512 bibliographies are presented for the time period from FY 77 to FY 79. Several non-SCR publications and a few papers not included in the last publication are included. Topics include propulsion, stratospheric emissions impact, materials and structure, aerodynamic performance, and stability and control. A.W.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also 34 Fluid Mechanics and Heat Transfer.

N80-11030*# United Technologies Research Center, East Hartford, Conn.
A COMPARISON OF THE PITCHING AND PLUNGING RESPONSE OF AN OSCILLATING AIRFOIL Final Report
Franklin O. Carta Washington NASA Oct. 1979 158 p refs (Contract NAS1-14012)
(NASA-CR-3172) Avail: NTIS HC A08/MF A01 CSCL 01A

An oscillating SC1095 airfoil model was tested for its aerodynamic stability in a rigid body with a single degree of freedom pitch about its quarter chord, and also in a rigid body with single degree of freedom plunge. The ability of pitching data to model plunging motions was evaluated. A one to one correspondence was established between pairs of pitching and plunging motions according to the potential flow transformation formula alpha = ikh. The imposed variables of the experiment were mean incidence angle, amplitude of motion, free stream velocity, and oscillatory frequency. Results indicate that significant differences exist between the aerodynamic responses to the motions, particularly at high load conditions. At high load conditions, the normal force for equivalent pitch is significantly greater than that for true pitch at the geometric incidence angle. R.C.T.

N80-11031*# Kentron International, Inc., Hampton, Va.
AIRCRAFT CONTROL BY PROPELLER CYCLIC BLADES
John DeYoung Washington NASA Nov. 1979 61 p refs (Contract NAS1-13500)
(NASA-CR-3212) Avail: NTIS HC A04/MF A01 CSCL 01A

A theory is developed for aircraft control obtained from the propeller forces and moments generated by blade angle variation during a blade revolution. The propeller blade is pitched harmonically one cycle per propeller revolution which results in vehicle control forces and moments, termed cyclic-control. Using a power series respresentation of an arbitrary function of cyclic-blade angle, cyclic-control theory is developed which leads to exact solutions in terms of derivatives of steady-state thrust and power with respect to blade angle. An alternative solution, when the cyclic-blade angle function is limited to a sinusoidal cycle, is in terms of Bessel functions. An estimate of non-steady azimuth angle change or lag is presented. Cyclic-control analysis applied to the counter-rotating propeller shows that control forces or moments can be uniquely isolated from each other. Thus the dual rotor, in hovering mode, has propulsion without rotor tilt or moments, or, when in propeller mode at the tail of an air ship or submarine, vehicle control with no vehicle movement. Control isolation is also attainable from three or more propellers in-line. Author

N80-11032# Aeronautical Research Labs., Melbourne (Australia).
PREDICTION OF HELICOPTER ROTOR DOWNWASH IN HOVER AND VERTICAL FLIGHT
K. R. Reddy Jan. 1979 31 p refs
(ARL-AERO-Rept-150; AR-001-335) Avail: NTIS HC A03/MF A01

A vortex-wake method to calculate the rotor downwash in hovering and vertical flight is presented. The blade is represented by a lifting line. The rotor wake is simulated by a vortex sheet and a series of rolled up root and tip vortices, similar in form to that of a classical fixed wing. The concept of rectangularization of the rotor wake is used in obtaining a formula for the normal component of induced velocity. Wake contraction based on experimental data is introduced into the calculations. Numerical calculations are performed for two rotor configurations. Computed induced velocities and blade loadings are compared with the available flight data. A.W.H.

N80-11033*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC INTERACTIONS FROM REACTION

CONTROLS FOR LATERAL CONTROL OF THE M2-F2 LIFTING-BODY ENTRY CONFIGURATION AT TRANSONIC AND SUPERSONIC AND SUPERSONIC MACH NUMBERS

Rodney O. Bailey and Jack J. Brownson Washington Nov. 1979 125 p refs

(NASA-TM-78534; A-7624) Avail: NTIS HC A06/MF A01 CSCL 01A

Tests were conducted in the Ames 6 by 6 foot wind tunnel to determine the interaction of reaction jets for roll control on the M2-F2 lifting-body entry vehicle. Moment interactions are presented for a Mach number range of 0.6 to 1.7, a Reynolds number range of 1.2 x 10 to the 6th power to 1.6 x 10 to the 6th power (based on model reference length), an angle-of-attack range of -9 deg to 20 deg, and an angle-of-sideslip range of -6 deg to 6 deg at an angle of attack of 6 deg. The reaction jets produce roll control with small adverse yawing moment, which can be offset by horizontal thrust component of canted jets. A.R.H.

N80-11034*# Pennsylvania State Univ., University Park.

CHARACTERISTICS OF LIGHTLY LOADED FAN ROTOR BLADE WAKES Final Report

B. Reynolds and B. Lakshminarayana Washington NASA Oct. 1979 192 p refs

(Grant NsG-3012)

(NASA-CR-3188; PSU-TURBO-R-78-4) Avail: NTIS HC A09/MF A01 CSCL 01A

Low subsonic and incompressible wake flow downstream of lightly loaded rotor was studied. Measurements of mean velocity, turbulence intensity, Reynolds stress, and static variations across the rotor wake at various axial and radial locations were investigated. Wakes were measured at various rotor blade incidences to discern the effect of blade loading on the rotor wake. Mean velocity and turbulence measurements were carried out with a triaxial hot wire probe both rotating with the rotor and stationary behind the rotor. Results indicate that increased loading slows the decay rates of axial and tangential mean velocity defects and radial velocities in the wake. The presence of large radial velocities in the rotor wake indicate the extent of the interactions between one radius and another. Appreciable static pressure variations across the rotor wake were found in the near wake region. Similarity in the profile shape was found for the axial and tangential components of the mean velocity and in the outer layer for axial, tangential, and radial turbulence intensities. R.C.T.

N80-11035*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

FLIGHT-MEASURED AFTERBODY PRESSURE COEFFICIENTS FROM AN AIRPLANE HAVING TWIN SIDE-BY-SIDE JET ENGINES FOR MACH NUMBERS FROM 0.6 TO 1.6

Louis L. Steers Washington Nov. 1979 88 p refs

(NASA-TP-1549; H-1066) Avail: NTIS HC A05/MF A01 CSCL 01A

Afterbody pressure distribution data were obtained in flight from an airplane having twin side-by-side jet exhausts. The data were obtained in level flight at Mach numbers from 0.60 to 1.60 and at elevated load factors for Mach numbers of 0.60, 0.90, and 1.20. The test altitude varied from 2300 meters (7500 feet) to 15,200 meters (50,000 feet) over a speed range that provided a matrix of constant Mach number and constant unit Reynolds number test conditions. The results of the full-scale flight afterbody pressure distribution program are presented in the form of plotted pressure distributions and tabulated pressure coefficients with Mach number, angle of attack, engine nozzle pressure ratio, and unit Reynolds number as controlled parameters. Author

N80-11036*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

FUSELAGE AND NOZZLE PRESSURE DISTRIBUTIONS ON A 1/12-SCALE F-15 PROPULSION MODEL AT TRANSONIC SPEEDS

Odis C. Pendergraft, Jr. Nov. 1979 140 p refs

(NASA-TP-1521; L-12948) Avail: NTIS HC A07/MF A01 CSCL 01A

Static pressure coefficient distributions on the forebody, afterbody, and nozzles of a 1/12 scale F-15 propulsion model were determined. The effects of nozzle power setting and horizontal tail deflection angle on the pressure coefficient distributions were investigated. A.W.H.

N80-11037*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL STUDY OF LOW ASPECT RATIO COMPRESSOR BLADING

Lonnie Reid and Royce D. Moore 1979 19 p refs Proposed for presentation at the 25th Ann. Intern. Gas Turbine Conf., New Orleans, La., 9-13 Mar. 1980; sponsored by Am. Soc. of Mech. Engr.

(NASA-TM-79280; E-217) Avail: NTIS HC A02/MF A01 CSCL 01A

The effects of low aspect ratio blading on aerodynamic performance were examined. Four individual transonic compressor stages, representative of the inlet stage of an advanced high pressure ratio core compressor, are discussed. The flow phenomena for the four stages are investigated. Comparisons of blade element parameters are presented for the two different aspect ratio configurations. Blade loading levels are compared for the near stall conditions and comparisons are made of loss and diffusion factors over the operating range of incidence angles. A.W.H.

N80-11038*# Old Dominion Univ. Research Foundation, Norfolk, Va.

LEADING EDGE VORTEX-FLAP EXPERIMENTS ON A 74 DEG DELTA WING

Dhanvad M. Rao Nov. 1979 53 p refs

(Grant NsG-1315)

(NASA-CR-159161) Avail: NTIS HC A04/MF A01 CSCL 01A

Exploratory wind tunnel tests are reported on a 74 deg. delta wing model. The potential of a vortex flap concept in reducing the subsonic lift dependent drag of highly swept, slender wings is examined. The suction effect of coiled vortices generated through controlled separation over leading edge flap surfaces to produce a thrust component is discussed. A series of vortex-flap configurations were investigated to explore the effect of some primary geomtric variables. A.W.H.

N80-11039# Texas Univ. at Austin.

SUPERSONIC FLOW MEASUREMENTS IN THE BODY VORTEX WAKE OF AN OGIVE NOSE CYLINDER Final Report

W. L. Oberkampf and T. J. Bartel Eglin AFB, Fla. AFATL Nov. 1978 302 p refs

(Contract F08635-77-C-0049; AF Proj. 2307)

(AD-A071337; AFATL-TR-78-127) Avail: NTIS HC A14/MF A01 CSCL 16/2

This report covers an experimental investigation of the symmetric body vortex wake of a circular cylinder in supersonic flow. Flow field measurements were made in the cross-flow plane at various axial body stations for angles of attack from 10 to 25 degrees. Data were obtained for two Reynolds numbers at a freestream Mach number of 2 and for one Reynolds number at a freestream Mach number of 3. A conical pressure probe was used to measure total pressure, Mach number, and three orthogonal velocity components at a large number of grid points in each of the survey planes. The pitch and yaw angles of the probe were manipulated in the wind tunnel in order to minimize any probe interference effects on the body vortex. A new experimental technique was used which involved the interaction of a theoretical predictive technique, a computer driven probe, and real time data quality optimization. Results are presented for the distribution of total pressure, Mach number, cross-flow velocity field, and axial velocity component in the cross-flow plane. These quantities are further processed to infer the position of the primary body vortex in the cross-flow plane, local circulation distribution in the cross-flow plane, vortex core size, wake height, and total circulation in the cross-flow plane. GRA

N80-11040# Tennessee Univ. Space Inst., Tullahoma.

THE ANALYSIS OF WING-BODY COMBINATIONS AT MODERATE ANGLES OF ATTACK

N. Uchiyama (Japan Defense Agency, Tokyo), R. P. Mikkilineni, and J. M. Wu 1978 7 p refs Presented at the AIAA 16th Aerospace Sci. Meeting, Huntsville, Ala., 16-18 Jan. 1978
(Contract DAAG29-77-G-0108)
(AD-A074284; ARO-14966.1-A-E) Avail: NTIS HC A02/MF A01 CSCL 20/4

A computational scheme is developed to predict the flow over wing-body combinations at moderate angles of attack and the results of computation are presented for two different wing-body combinations. The wing is represented by a system of discrete non-intersecting vortex lines. Each vortex line in the wake is composed of a series of straight finite segments and a semi-infinite segment. The body is represented by a system of source/sink elements distributed on the surface of the body. The effect of lifting nose is taken into account by a horseshoe vortex system, the strength and the location of which are based on the empirical relations. The basic unknowns in the problem are the strengths of the vortex elements and the source/sink elements, and the direction of the vortex elements in the wake. The problem is solved using an iterative approach. The shape of the trailing vortex sheet is shown at different stations along the body. A.R.H.

N80-11041# Maryland Univ., College Park. Dept. of Aerospace Engineering
NEW COMPUTATIONAL MODELS IN CONTINUUM MECHANICS Final Report
Oleg Beltserkovski Mar. 1979 94 p refs
(Contract N00014-79-M-0022)
(AD-A071418; AE-79-1) Avail: NTIS HC A05/MF A01 CSCL 20/4

Direct numerical simulation of complex gas dynamics problems (computational experiment) is performed with the help of Euler, Navier-Stokes and Boltzmann equations. The basic principles of the computational experiment are formulated and the results for various gas dynamics problems of a complex internal structure are presented. The problems examined include the transonic regime (super-critical flows including transition through sound velocity), flows with a jet injected into the main stream and diffraction problems. Body wake flows are studied at various Reynolds numbers. The structure of a shock wave provides an example of rarefied gas flows at various Mach numbers. A set of control tests is worked out for the estimation of calculation accuracy. GRA

N80-11042# Illinois Univ. at Urbana-Champaign. Dept. of Mechanical and Industrial Engineering.
SEPARATED FLOW PROBLEMS WITHIN THE TRANSONIC AND SUPERSONIC FLOW REGIMES Final Report, 5 Apr. 1976 - 31 May 1979
W. L. Chow Jun. 1979 27 p refs
(Grant DAAG29-76-G-0199)
(AD-A071899; ME-TR-395-8; ARO-13510.8-E) Avail: NTIS HC A03/MF A01 CSCL 20/4

The base pressure associated with supersonic axisymmetric flow past a backward facing step, employing previously developed analysis of recompression, reattachment, and redevelopment processes, has been calculated for small supersonic approaching flow Mach numbers with thin initial boundary layers. The model of dealing with transonic flow past a backward facing step in two-dimensional or axisymmetric configuration has been successfully developed. Large scaled calculations of the turbulent Navier-Stokes equation based on the 'two-equation model', has been carried out for the low speed flow past a two-dimensional backstep, where a considerable amount of hot-wire data is available for compression and good description of the overall flow pattern has been obtained. Numerical calculations of the potential flow after hodograph transformation have been proved to be fruitful by solving many previously unsolved problems where the effect of gravitation predominates. GRA

N80-11043# California Univ., Livermore. Lawrence Livermore Lab.
MACH 130 AIR SHOCK ATTENUATION STUDIES
H. D. Glenn, H. R. Kratz, D. D. Keough, and R. P. Swift 30 Nov. 1978 19 p refs Presented at the Nucl. Blast and Shock Simulation Symp., San Diego, Calif., 28 Nov. 1978
(Contract W-7405-eng-48)
(UCRL-82012; Conf-781197-1) Avail: NTIS HC A02/MF A01

Voitenko compressors were used to generate approximately 4.5 cm/micron sec air shocks in a steel and a grout outlet pipe. Diaphragm burst times and time-of-arrival data of shock-front luminosity along the 2 cm i.d. exit pipes are provided by fiber-optics ports. Pressure profiles were obtained for this high enthalpy shock propagation at many locations in both experiments. The effect of wall material on high-energy shock propagation was investigated. In the interval between 10 and 250 cm from the diaphragm the velocity and peak pressure of the shock front attenuated from approximately 4.5 to 0.5 cm/micron sec and approximately 21 to approximately 0.2 kb, respectively. Over this distance, the shock propagation gave nearly identical results for both experiments within the range of experimental accuracy. This rapid attenuation of the shock front velocity and pressure is attributed to ablation and entrainment of wall material. Results indicate that the shock propagation is independent of wall composition to the extent of materials considered over the 250 cm distance of the outlet pipes. DOE

N80-11044# Aeronautical Research Inst. of Sweden, Stockholm.
MEASUREMENTS ON A THREE-DIMENSIONAL SWEPT WING AT LOW SPEEDS. PART 1: THE FLOW AROUND THE LEADING EDGE
Arild Bertelrud Sep. 1977 112 p refs Sponsored by Swed. Defence Mat. Admin. 2 Vol.
(FFA-130-Pt-1; PB-294203/5) Avail: NTIS HC A06/MF A01

As a part of a project on extrapolation from wind tunnel to flight, measurements in the boundary layer of a three dimensional swept wing were made in a low speed wind tunnel. The flow in the region close to the leading edge was studied. Two different flow patterns were investigated; natural transition and bubble transition. The wing tested is outer part of the actual wing of a SAAB 32 Lansen with a NACA 64A010 profile normal to the 25 percent line and a leading edge sweep of 39 deg. It is found that for the present wing the pressure distribution in the leading edge region back to 30 percent of the chord is well described by two-dimensional calculations of attack close to start of separation the attachment line flow probably becomes transitional/turbulent in the tested speed range, followed by relaminarization and bubble. According to calculations there should not be relaminarization in the flight case, despite strong indications from earlier flight tests of bubble separation. Author (ESA)

N80-11045# Aeronautical Research Inst. of Sweden, Stockholm.
MEASUREMENTS ON A THREE-DIMENSIONAL SWEPT WING AT LOW SPEEDS. PART 2: THE FLOW IN THE BOUNDARY LAYER ON THE MAIN WING
Arild Bertelrud Sep. 1977 85 p refs Sponsored by Swed. Defence Mat. Admin. 2 Vol.
(FFA-131-Pt-2; PB-294204/3) Avail: NTIS HC A05/MF A01

As a part of a project on extrapolation from wind tunnel to flight, measurements in the boundary layer of three-dimensional swept wing were made in a low speed tunnel. The flow on the main part of the wing is discussed and essentially time-averaged information is given. The experimental investigation consists of measurements of the static distribution and also of measurements with total head/static probes. These also provide skin friction data. As the flow visualizations and the preliminary measurements indicated that the flow was close to two dimensional, boundary layer rakes were used to get streamwise information on the boundary layer profiles. Calculations of the static pressure distribution and the turbulent boundary layer characteristics were performed and show good agreement with the experimental results. Author (ESA)

N80-11046# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
COMPARISON OF BOUNDARY LAYER CALCULATION FOR A WING: THE MAY 1978 STOCHOLM WORKSHOP TEST CASE
D. A. Humphreys Jan. 1979 121 p refs
(FFA-AE-1522) Avail: NTIS HC A06/MF A01

Eight calculation methods for determining three-dimensional turbulent boundary layers were compared. All methods were applied to the same test case which was designed to simulate flow over a wind tunnel model wing. Geometry and free stream

conditions were chosen to be representative, yet to yield a relatively simple compressible (subsonic) boundary layer with only moderate three-dimensionality and spanwise variation. Wing root, tip, and leading edge regions were excluded. Two wing incidences were considered. The main comparison of the calculation methods involved comparing four parameters appearing in the integral equations of motion in streamline coordinates. Despite the simplicity of the test case, disproportionately large differences were evident among the outputs of the eight programs (as much as 10 percent or 20 percent typically). Possible explanations for these discrepencies are suggested. Author (ESA)

N80-11047# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

AN EXPERIMENTAL SURVEY OF A SEPARATED REGION ON A CONICAL AFTERBODY IN A SUPERSONIC FREE STREAM Final Report

Johan Agrell Oct. 1978 24 p refs

(Contract FMV-F-VT-81713-74-013-07-001)

(FFA-TN-AU-1187) Avail: NTIS HC A02/MF A01

The separated flow region on a boat-tailed afterbody was investigated experimentally at a Mach number of 2.00 during wind tunnel tests. The size of the reversed flow region was determined and, where possible, the velocity of the recirculating flow was estimated. Experimental methods comprised different types of pressure probes and flow visualization techniques. Despite the shortcomings of the method qualitative profiles of the local Mach number in the reverse flow were obtained. Author (ESA)

N80-11048# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

PITOT PRESSURE AND TOTAL TEMPERATURE PROFILE MEASUREMENTS IN A HYPERSONIC, TURBULENT BOUNDARY LAYER AT M = 9

R. P. Bartlett, A. J. Edwards, J. K. Harvey, and R. Hilier Feb. 1979 36 p refs

(Contract AT/2037/084)

(IC-Aero-79-01) Avail: NTIS HC A03/MF A01

Pitot pressure and total temperature profiles were measured in a zero pressure gradient, turbulent, hypersonic boundary layer under conditions of severe cooling. Velocity profiles were calculated and compared with several available velocity - total temperature relationships. The van Driest transformation was used to compare the data with well-known incompressible results. Results and estimates of the wake component suggested the boundary layer was not fully developed. Author (ESA)

N80-11049# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

A SURVEY OF THE LITERATURE ON SURFACE ROUGHNESS EFFECTS ON THE DRAG OF SUBSONIC AIRCRAFT Final Report

A. Bertelrud Sep. 1978 131 p refs

(Contracts SWEDBTD-75-4494; SWEDBTD-76-4505)

(FFA-AU-1224) Avail: NTIS HC A07/MF A01

A survey of selected investigations concerning drag associated with isolated or distributed roughness elements in laminar and turbulent flow is given. Basic roughness types tested in laboratory experiments are covered and the results are related to conditions on wings of subsonic aircraft. Whereas considerable information is available on zero-pressure-gradient two-dimensional turbulent flows with roughness effects can be incorporated in current routines for assessing overall drag of aircraft based on wind tunnel and flight tests is demonstrated. It is suggested to develop a computer code which will allow the determination of allowable roughness size, or the effect of given roughness size on drag for new aircraft. This program would also make possible predictions of the degradation in performance associated with maintenance procedures, structural modifications, etc. Such a program involves a detailed analysis of the flow field around wing and body instead of the over-simplified methods based on flat plate relations now in use. Author (ESA)

N80-11008 Allerton Press, Inc., New York, N. Y.

SURFACE-EFFECT COMPONENTS OF AERODYNAMIC CHARACTERISTICS OF AIR-CUSHION VEHICLE WITH RAM PRESSURIZATION

M. A. Guryanov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 10-19 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 17-29 (For primary document see N80-11002 02-01)

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N80-11008 Allerton Press, Inc., New York, N. Y.

AERODYNAMIC HEATING OF BLUNT WEDGES

N. M. Krutova, T. I. Murashina, and G. B. Petrazhitskii *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 33-36 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 44-48 (For primary document see N80-11002 02-01)

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N80-11009 Allerton Press, Inc., New York, N. Y.

SELECTION OF GEOMETRIC PARAMETERS AND LOCATION OF NOSE FLAP ON SWEPT WING ROOT PROFILE FROM TUNNEL TEST DATA. 1

A. I. Matyazh, V. A. Sterlin, V. A. Popov, V. V. Isaev, and G. A. Cheremukhin *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 37-41 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 49-54 (For primary document see N80-11002 02-01)

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N80-11010 Allerton Press, Inc., New York, N. Y.

ANALYTIC FORMULAS FOR WING PROFILE AERODYNAMIC CHARACTERISTICS IN INCOMPRESSIBLE FLOW

N. M. Monakhov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 42-47 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 55-61 (For primary document see N80-11002 02-01)

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N80-11011 Allerton Press, Inc., New York, N. Y.

ON A SMOOTH APPROXIMATION METHOD AND ITS APPLICATION TO MATHEMATICAL DESCRIPTION OF WING AERODYNAMIC CHARACTERISTICS

V. A. Ovchinnikov, V. D. Osorgin, V. G. Pavlov, and E. Ya. Fedorov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 48-51 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 62-65 (For primary document see N80-11002 02-01)

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N80-11012 Allerton Press, Inc., New York, N. Y.

INFLUENCE OF WING DEFORMATION ON TRAILING-EDGE FLAP DEFLECTIONS

V. A. Pavlov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 52-53 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 66-67 (For primary document see N80-11002 02-01)

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SOLUTION OF THE INVERSE AERODYNAMICS PROBLEM BY THE RANDOM SEARCH METHOD

G. D. Peshatov and Yu. N. Novoselov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 54-58 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 68-73 (For primary document see N80-11002 02-01)

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N80-11019 Allerton Press, Inc., New York, N. Y.

HARMONIC OSCILLATIONS OF ANNULAR WING IN STEADY IDEAL FLUID FLOW

Z. N. Shesternina *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 93-98 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 115-121 (For primary document see N80-11002 02-01)

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N80-11022 Allerton Press, Inc., New York, N. Y.
OVERALL AERODYNAMIC CHARACTERISTICS OF CARET AND DELTA WINGS AT SUPERSONIC SPEEDS
Yu P. Gunko and I. I. Mazhul In its Soviet Aeron., Vol. 21, No. 2 1978 p 107-110 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 129-132 (For primary document see N80-11002 02-01)
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N80-11026 Allerton Press, Inc., New York, N. Y.
MIXED INVERSE PROBLEM FOR PROFILE WITH GIVEN VELOCITY DISTRIBUTION ON ONE SIDE AND KNOWN THICKNESS LAW
S. D. Kostomoi and A. A. Litvinenko In its Soviet Aeron., Vol. 21, No. 2 1978 p 120-122 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 142-144 (For primary document see N80-11002 02-01)
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N80-11027 Allerton Press, Inc., New York, N. Y.
ON FREE PERIODIC PARACHUTE SYSTEM OSCILLATIONS IN THE AXIAL PLANE
V. M. Churkin and N. A. Kosarchuk *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 144-146 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 144-146 (For primary document see N80-11002 02-01)
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03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-11050# National Aviation Facilities Experimental Center, Atlantic City, N. J.
CABIN HAZARDS FROM A LARGE EXTERNAL FUEL FIRE ADJACENT TO AN AIRCRAFT FUSELAGE Final Report
Louis J. Brown, Jr. Aug. 1979 59 p refs
(FAA Proj. 181-521-100)
(AD-A073494; FAA-NA-79-27) Avail: NTIS HC A03/MF A01 CSCL 13/12

Fourteen fire tests were conducted with a surplus, fire hardened DC 7 fuselage. The flame penetration and resulting accumulation of heat and smoke inside an aircraft cabin, produced by a large external fuel fire adjacent to a fuselage door opening, was measured and studied. Temperatures, light transmittances, and heat fluxes were measured. The effect of wind direction and velocity on the flame propagation and penetration were investigated. A.W.H.

N80-11051# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT - UNITED AIRLINES, INC., MCDONNELL-DOUGLAS DC-8-61, N8082U, PORTLAND, OREGON, DECEMBER 28, 1978
7 Jun. 1979 63 p
(NTSB-AAR-79-7) Avail: NTIS HC A04/MF A01

The crash of flight 173, a DC 8 aircraft, is investigated. The cause of the accident is listed as flight crew error in responding to the low fuel state of the aircraft due to a malfunction in the landing gear. Damage to the aircraft and injuries to persons are reported. Wreckage information, an aircraft systems examination, a fuel control test, and a report of the main landing gear retract cylinder assembly are discussed. A.W.H.

N80-11052*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRCREW DISPLAYS AND AVIONICS FOR APPLICATION IN A FUTURE NATIONAL AIRSPACE SYSTEM
Seymour Salmirs Nov. 1979 28 p refs
(NASA-TM-80095) Avail: NTIS HC A03/MF A01 CSCL 01D

A concept for increased pilot involvement in a future National Airspace System was evolved during the FAA New Initiatives in Engineering and Development Users responsibilities and ways in which they might interact. The technical feasibility of the system is indicated by the sophisticated level of presently manufactured digital computers and display avionics, and the application of that technology under design by the major airframe manufacturers. Data collected during simulations and flights with the Terminal Configured Vehicle Program B-737 airplane are shown to have direct application to the new system concept. The adoption of the operational changes envisioned, offers some potentially significant advantages to the user. Author

N80-11053*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MULTIROLE CARGO AIRCRAFT OPTIONS AND CONFIGURATIONS
D. William Conner and John C. Vaughan, III (USAF) Oct. 1979 15 p refs Presented at 1979 SAE Aerospace Meeting, 3-9 Dec. 1979
(NASA-TM-80177) Avail: NTIS HC A02/MF A01 CSCL 01C

A future requirements and advanced market evaluation study indicates derivatives of current wide-body aircraft, using 1980 advanced technology, would be economically attractive through 2008, but new dedicated airfreighters incorporating 1990 technology, would offer little or no economic incentive. They would be economically attractive for all payload sizes, however, if RD and T costs could be shared in a joint civil/military arrangement. For the 1994-2008 cargo market, option studies indicate Mach 0.7 propfans would be economically attractive in trip cost, aircraft price and airline ROI. Spanloaders would have an even lower price and higher ROI but would have a relatively high trip cost because of aerodynamic inefficiencies. Dedicated airfreighters using propfans at Mach 0.8 cruise, laminar flow control, or cryofuels, would not provide any great economic benefits. Air cushion landing gear configurations are identified as an option for avoiding runway constraints on airport requirements and/or operational constraints are noted. Author

N80-11054# Douglas Aircraft Co., Inc., Long Beach, Calif.
EJECTION SEAT FOR HIGH G ESCAPE Final Technical Report, 1 Jun. 1978 - Apr. 1979
Orville E. Howland Apr. 1979 184 p refs
(Contract F33615-78-C-3416; AF Proj. 2402)
(AD-A072444; MDC-J8434; AFFDL-TR-79-3044) Avail: NTIS HC A09/MF A01 CSCL 06/7

Advanced flight vehicles operating at acceleration loads beyond human functional capabilities require a new reclining seat design. An ejection seat compatible with this requirement must provide safe ejection and aircraft clearances under high-G conditions as well as the requirements associated with high dynamic pressures and low altitudes. Design criteria and interface requirements have been established. Ejection seat subsystems have been developed and seat design concepts generated to meet criteria and interface requirements. Candidate seat concepts have been analyzed to determine cockpit integration effects, accelerations, ejection clearances, escape performance, structural requirements and weights. A final design concept has been selected to meet all requirements of an ejection seat for high-G escape. The final report includes a parametric study of tail clearances and discusses technical design details and conclusions of the work performed. GRA

N80-11055# Rockwell International Corp., El Segundo, Calif. Los Angeles Div.
EXPLORATORY DEVELOPMENT OF AIRCREW WINDBLAST PROTECTION CONCEPTS Final Report, May 1978 - Jan. 1979
Robert J. Cummings and Frank E. Drsata Jun. 1979 100 p refs

(Contract F33615-78-C-0514; AF Proj. 7231)
(AD-A072013; RI/LAD-NA-79-77; AMRL-TR-79-16) Avail: NTIS HC A05/MF A01 CSCL 06/7

Design requirements for windblast limb protection systems to be used in current ejection seats were defined. The ACES II system was used as a baseline system. Using the baseline seat and the requirements, three arm and three leg restraint concepts were defined. A proposed program was then defined to evaluate and develop the proposed systems. Design requirements were derived from a list of criteria or constraints for the system as defined in the reference to the escape, aircraft, crew flight conditions and using commands' needs. Resulting requirements were then rank ordered and significant interactions between them identified. Identification of negative interactions highlights the significant trades necessary to design a successful windblast protection system. Ejection events and the resulting environment the crew is exposed to were then analyzed to define the physical actions the men and system must contend with. Review of previous ejection injuries and limb restraint systems was included to further refine the understanding of injury mechanisms. Specific injury mechanisms of the knees, shoulder, elbow, and spinal column are presented. Using the requirements and injury mechanisms the six candidate protection systems were defined. A proposed program for concept refinement and final selection is presented. GRA

N80-11056# Coast Guard, Washington, D.C. Oceanographic Unit.
LIFE RAFT STUDY, FEBRUARY 1978
R. W. Scobie and D. L. Thompson Apr. 1979 33 p refs
(AD-A073055; CGOU-TR-79-1) Avail: NTIS HC A03/MF A01 CSCL 06/7

A life raft study was conducted from the CGC EVERGREEN in February 1978. Of the six life rafts tested, only one was seen capsizing. The Givens life raft suffered the most damage with both the canopy and ballast bag being destroyed. Leeway for life rafts with improved ballast systems was found to follow the equation $U(\text{life raft}) = 0.042\ U(\text{wind}) + 0.060$. This type of life raft was noted to drift at a much slower rate when the canopy was not deployed. In over 80% of the cases the life rafts drifted within 45 degrees of the downwind direction. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-11057# Sterling Systems, Inc., Washington, D. C.
AN ASSESSMENT OF TERMINAL AIR TRAFFIC CONTROL SYSTEM PERFORMANCE WITH AND WITHOUT BASIC METERING AND SPACING AUTOMATION Final Report
H. C. Wintermoyer, William Pallen, and Donald Meyer Mar. 1979 134 p refs
(Contract DOT-FA79WAI-012)
(AD-A073548; FAA-RD-79-81) Avail: NTIS HC A07/MF A01 CSCL 17/7

Basic arrival metering and spacing (M&S), developed as an ARTS (automated radar terminal system) 3 enhancement, is discussed. The functions of metering arrival aircraft prior to their acceptance in terminal airspace, sequencing them according to their estimated time at the runway, scheduling each aircraft at fix points along the arrival path to the runway arrival gate, and providing control commands to assure precise and proper spacing for aircraft on final approach to the runway are examined. Simulation tests to determine the landing time interval error, the potential safe landing rate, and the potential excessive delay are described. A.W.H.

N80-11058*# Sperry Flight Systems, Phoenix, Ariz.
STUDY FOR INCORPORATING TIME-SYNCHRONIZED APPROACH CONTROL INTO THE CH-47/VALT DIGITAL NAVIGATION SYSTEM
Walter J. McConnell, Jr. Oct. 1979 226 p refs
(Contract NAS1-14238)
(NASA-CR-159151) Avail: NTIS HC A11/MF A01 CSCL 17G

Techniques for obtaining time synchronized (4D) approach control in the VALT research helicopter is described. Various 4D concepts and their compatibility with the existing VALT digital computer navigation and guidance system hardware and software are examined. Modifications to various techniques were investigated in order to take advantage of the unique operating characteristics of the helicopter in the terminal area. A 4D system is proposed, combining the direct to maneuver with the existing VALT curved path generation capability. A.W.H.

N80-11059# Air Force Academy, Colo.
FALCONFIX: A MULTI-MODAL APPROACH TO FIX COMPUTATION Final Report
William T. Hodson, III and Joseph C. H. Smith Jun. 1979 77 p
(AD-A072527; USAFA-TR-79-5) Avail: NTIS HC A05/MF A01 CSCL 17/3

FALCONFIX is a new algorithm for computing the location of an emitter given the bearings from a number of direction-finding stations located worldwide. This approach assumes that each reported bearing may be considered as a sample from a composite normal/uniform distribution, thereby explicitly acknowledging that the bearing may be either true or wild. These distributions are used to create a likelihood function defined over the unit sphere. Non-linear programming techniques are then employed to identify all relative maxima (modes) of this function. The modes (which coincide with concentrations of bearings) are then ordered by value and reported as estimates of the emitter location. GRA

N80-11060# Honeywell, Inc., St. Petersburg, Fla.
LIMS: LASER INERTIAL MEASUREMENT SYSTEM Final Report
Jul. 1978 18 p
(Contract DAAK40-76-C-0665)
(AD-A072389) Avail: NTIS HC A02/MF A01 CSCL 17/7

Acceptance and delivery of the items described was accomplished. A summary acceptance test report was provided for each LIMU delivered. The anomalies and/or failures during these acceptance test were primarily due to remaining hardware development problems and procedure development problems, not unusual for new items. After these developmental problems were solved, the LIMU's capability of meeting the requirements established for it, was adequately demonstrated as evidenced by the fact that the last four acceptance tests were accomplished in a 2 month interval and were routine in nature. GRA

N80-11061# Boeing Aerospace Co., Seattle, Wash. Military Airplane Development Organization.
EVALUATION OF DAIS TECHNOLOGY APPLIED TO THE INTEGRATED NAVIGATION SYSTEM OF A TACTICAL TRANSPORT Final Report, Sep. 1977 - May 1979
Donald Dewey, Richard Bousley, Stephen Behnen, and James Mason May 1979 181 p refs
(Contract F33615-77-C-1233; AF Proj. 2003)
(AD-A073068; AFAL-TR-79-1061) Avail: NTIS HC A09/MF A01 CSCL 17/7

This effort has provided an independent contractor assessment of the DAIS executive software, industry exposure to the J-73 level one compiler and DAIS software development tools, and a definition of the interface between DAIS and integrated navigation systems. A combination of INS, GPS and air data was used to demonstrate the usefulness of the DAIS/integrated navigation system for tactical air drop and terminal area operations w/transport aircraft. A Boeing Aerospace Lab Simulation jointly managed by AFAL and Boeing, was conducted for the purposes of evaluating the DAIS/integrated navigation system software performance capabilities in a simulated tactical air drop and terminal area navigation flight profile. A 'Hot Bench' simulation was conducted using contractor developed sensor software modules and navigation filter, and the DAIS executive software and processing hardware. Outputs of the program include: Verification of the overall DAIS concept, measurements of

executive software overhead and suggestions for improving the DAIS executive software. GRA

N80-11062# National Technical Information Service, Springfield, Va.
AIR TRAFFIC CONTROL SIMULATION MODELS VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Jul. 1979
Guy E. Habercom, Jr. Aug. 1979 179 p refs Supersedes NTIS/PS-77/0702; NTIS/PS-76/0610; NTIS/PS-75/521; NTIS/PS-78/0788
(NTIS/PS-79/0799/1; NTIS/PS-78/0788; NTIS/PS-77/0702; NTIS/PS-76/0610; NTIS/PS-75/521) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

En-route and terminal air traffic control facilities are investigated by use of mathematical models and computerized simulations. Ground based and satellite navigational aids are modeled for present and predicted air traffic requirements. Worldwide networks for traffic scheduling are simulated. This updated bibliography contains 169 abstracts, 44 of which are new entries to the previous edition. GRA

N80-11063# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
TRI-FAST HARDWARE-IN-THE-LOOP SIMULATION. VOLUME 1: TRI-FAST HARDWARE-IN-THE-LOOP SIMULATION AT ADVANCED SIMULATION CENTER
David B. Merriman, Robert C. Ward, James T. Taylor (Boeing Aerospace Co., Huntsville, Ala.), and C. R. Green (Computer Sciences Corp., Huntsville, Ala.) 28 Mar. 1979 86 p
(AD-A072919; DRDMI-T-79-43-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 17/7

The purpose of this report is to document the Tri-FAST missile simulation development and the seeker hardware-in-the-loop (HWIL) testing in the Radio Frequency Simulation Cell of the Advanced Simulation Center (ASC). Tri-FAST is a tri-service active seeker technology program. GRA

N80-11064# New Mexico Univ., Albuquerque. Technology Application Center.
INERTIAL NAVIGATION AND GUIDANCE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jul. 1979
Samuel C. Mauk Aug. 1979 50 p Sponsored in part by NTIS
(NTIS/PS-79/0825/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

This bibliography cites 208 articles from the international literature concerning air navigation, navigation instruments and aids, aircraft guidance, missile control, strapdown inertial guidance, gyroscopes, stabilized platforms, position and instrument error, error analysis, and accelerometers. Civil, commercial, and military applications are covered. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics.

N80-11065*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A HYDRAULIC ACTUATOR MECHANISM TO CONTROL AIRCRAFT SPOILER MOVEMENTS THROUGH DUAL INPUT COMMANDS Patent Application
Stephen C. Irick, inventor (to NASA) Filed 17 Aug. 1979 11 p
(NASA-Case-LAR-12412-1; US-Patent-Appl-SN-067595) Avail: NTIS HC A02/MF A01 CSCL 10C

A conventional, primary spoiler control system retains its operational characteristics while accommodating a secondary input controlled by a conventional computer system to supplement the settings made by the primary input. This is achieved by interposing springs between the primary input and the spoiler control unit. The springs are selected to have a stiffness intermediate to the greater force applied by the primary control linkage and the lesser resistance offered by the spoiler control unit. Thus, operation of the primary input causes the control unit to yield before the springs, yet, operation of the secondary input, acting directly on the control unit, causes the springs to yield and absorb adjustments before they are transmitted into the primary control system. NASA

N80-11066# National Aerospace Lab., Tokyo (Japan). V/STOL Div.
FUEL MINIMAL TAKE-OFF PATH OF JET LIFT VTOL AIRCRAFT, LOG NO. C3558
Hiroshi Nishimura 7 Aug. 1979 40 p refs Backup document for AIAA synoptic scheduled for publication in Journal of Aircraft on Feb. 1980
Avail: NTIS HC A03/MF A01

The fuel minimal take-off path analysis for jet lift type VTOL aircraft is presented. The study is made of two basic configurations, namely, separate type and swivel type. The fuel minimal take-off path problems of the two configurations are analyzed as nonlinear systems with the controls constrained by their magnitude. The solutions for both types are generally composed of two or three discontinuous segments connected by switching points. For the separate type, the singular part is analytically deterministic and unique, and plays a decisive role; but for the swivel type, the singular part is not unique. Two methods of solution involving different handling of singular parts are considered. Author

N80-11067*# United Technologies Research Center, East Hartford, Conn.
NOISE OF A MODEL HELICOPTER ROTOR DUE TO INGESTION OF TURBULENCE Final Report
Robert W. Paterson and Roy K. Amiet Nov. 1979 131 p refs
(Contract NAS1-15094)
(NASA-CR-3213) Avail: NTIS HC A07/MF A01 CSCL 01C

A theoretical and experimental investigation of the noise of a model helicoper rotor due to ingestion of turbulence was conducted. Experiments were performed with a 0.76 m dia, articulated model rotor for a range of inflow turbulence and rotor operating conditions. Inflow turbulence levels varied from approximately 2 to 19 percent and tip Mach number was varied from 0.3 to 0.52. Test conditions included ingestion of a atmospheric turbulence in outdoor hover as well as ingestion of grid generated isotropic turbulence in the wind tunnel airstream. In wind tunnel testing, both forward flight and vertical ascent (climb) were simulated. Far field noise spectra and directivity were measured in addition to incident turbulence intensities, length scales, and spectra. Results indicate that ingestion of atmospheric turbulence is the dominant helicopter rotor hover noise mechanism at the moderate to high frequencies which determine perceived noise level. R.C.T.

N80-11068*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WIND-TUNNEL/FLIGHT CORRELATION STUDY OF AERODYNAMIC CHARACTERISTICS OF A LARGE FLEXIBLE SUPERSONIC CRUISE AIRPLANE (XB-70-1). 1: WIND-TUNNEL TESTS OF A 0.03-SCALE MODEL AT MACH NUMBERS FROM 0.6 TO 2.53
James Daugherty, C. Nov. 1979 222 p refs
(NASA-TP-1514; A-7712) Avail: NTIS HC A10/MF A01 CSCL 01C

The longitudinal and lateral forces and moments for a 0.03 scale deformed rigid, static force model of the XB-70-1 airplane were determined. Control effectiveness was determined for the elevon in pitch and roll, for the canard, and for the rudders. Component effects of the canard, deflected with tips, variable position canopy, bypass doors, and bleed dump fairing were measured. The effects of small variations in inlet mass flow ratio and small amounts of asymmetric deflection of the wing tips were assessed. A.W.H.

N80-11069*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF MODIFIED PROFILE ANALYSIS TO FUNCTION TESTING OF SIMULATED CTOL TRANSPORT

TOUCHDOWN-PERFORMANCE DATA
Russell V. Parrish and Burnell T. McKissick Nov. 1979 19 p refs
(NASA-TP-1541; L-13091) Avail: NTIS HC A02/MF A01 CSCL 01C

The modification to the methodology of profile analysis to accommodate the testing of differences between two functions with a single test, rather than multiple tests at various values of the abscissa, is described and demonstrated for two sets of simulation-performance data. The first application was to a flight-simulation comparison of pilot-vehicle performance with a three-element refractive display to performance with a more widely used beam-splitter-reflective-mirror display system. The results demonstrate that the refractive system for out-the-window scene display provides equivalent performance to the reflective system. The second application demonstrates the detection of significant differences by modified profile-analysis procedures. This application compares the effects of two sets of pitch-axis force-feel characteristics on the sink rate at touchdown performance utilizing the refractive system. This experiment demonstrates the dependence of simulator sink-rate performance on force-feel characteristics. Author

N80-11070# Rockwell International Corp., El Segundo, Calif. Los Angeles Div.
IMPROVED METHODS FOR PREDICTING SPECTRUM LOADING EFFECTS, PHASE 1 REPORT, VOLUME 2: TEST DATA Interim Report, 15 Feb. 1978 - 15 Jan. 1979
James B. Chang and John H. Stolpestad 31 Jan. 1979 330 p
(Contract F33615-77-C-3121)
(AD-A072387; NA-78-491-3-Vol-2; AFFDL-TR-79-3036-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 01/3

This report presents the interim status of a program which is aiming to upgrade the crack growth prediction technology required for the implementation of the damage-tolerance and durability control procedures throughout the life cycle of any weapon system. The controlling damage parameters in flight-by-flight loading for all classes of aircraft have been identified. Methodologies which characterize the flight spectra have been developed. Guidelines for development of three levels of crack growth analysis used for detail design, individual aircraft tracking, and preliminary design have been established. Crack growth data generated from the test program has been summarized. GRA

N80-11071# Rockwell International Corp., El Segundo, Calif. Los Angeles Div.
IMPROVED METHODS FOR PREDICTING SPECTRUM LOADING EFFECTS, PHASE 1 REPORT, VOLUME 1: RESULTS AND DISCUSSION Interim Report, 15 Feb. 1978 - 15 Jan. 1979
James B. Chang, John H. Stolpestad, Masanobic Shinozuka, and Rimas Vaicaitis 31 Jan. 1979 333 p refs Prepared in cooperation with Modern Analysis, Inc.
(Contract F33615-77-C-3121)
(AD-A072386; NA-78-491-3-Vol-1; AFFDL-TR-79-3036-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 01/3

This report presents the interim status of a program which aims to upgrade the crack growth prediction technology required for the implementation of the damage-tolerance and durability control procedures throughout the life cycle of any weapon system. The controlling damage parameters in flight-by-flight loading for all classes of aircraft have been identified. Methodologies which characterize the flight spectra have been developed. Guidelines for development of three levels of crack growth analysis used for detail design, individual aircraft tracking, and preliminary design have been established. GRA

N80-11072# Delaware Univ., Newark. Center for Composite Materials.
DESIGN OF THE SPAR-WINGSKIN JOINT Final Report, 1 Sep. 1977 - 15 Dec. 1978
Ralph D. Cope and R. Byran Pipes Wright-Patterson AFB, Ohio Air Force Flight Dynamics Lab. Mar. 1979 188 p refs
(Contract F33615-77-C-3132; AF Proj. 2401)
(AD-A072426; AFFDL-TR-79-3015) Avail: NTIS HC A09/MF A01 CSCL 13/5

A variety of spar-wingskin joint concepts were investigated to optimize out-of-plane strength while still providing low weight and ease of fabrication. The spar-wingskin configuration consists of a thin spar which overlaps and is co-cured perpendicular to a thick wingskin. Investigation parameters were the joint geometry in the immediate vicinity of the base of the spar, and the spar-to-spar spacing. It was found that by varying the overlap geometry and decreasing the interspar spacing, a significant increase in out-of-plane strength could be realized. A theoretical analysis was made by the extended use of the finite element technique. Joint strength was predicted through the application of Tsai-Wu and maximum stress failure criteria. These results were verified by comparison to experimental results in which all significant concepts were fabricated and tested. GRA

N80-11073# Nielsen Engineering and Research, Inc., Mountain View, Calif.
PREDICTION OF LATERAL AERODYNAMIC LOADS ON FIGHTER AIRCRAFT AT HIGH ANGLES OF ATTACK Summary Technical report, 1 May 1977 - 31 Jul. 1978
S. B. Spangler and S. C. Perkins, Jr. 31 Jul. 1978 86 p refs
(Contract N00014-74-C-0344)
(AD-A071893; NEAR-TR-173; ONR-CR212-225-4F) Avail: NTIS HC A05/MF A01 CSCL 20/4

This report presents a brief summary of methods and experimental data developed over a four year period, to predict the static lateral forces acting on a modern fighter-type aircraft at high angles of attack, and small angles of sideslip characteristic of a departure flight attitude. The major part of the report is devoted to application of the methods to two aircraft configurations on which detailed data exist, comparison of the predicted and measured results, and evaluation of the comparisons. The configurations are a research V/STOL fighter configuration and the F-5 aircraft. Comparisons are made on nose vortex positions, circulation distributions in the separated region above the nose, flow velocities in the same region, and loads on the nose alone and complete configuration. Generally, the methods predict all of the correct behavior of these highly nonlinear and complicated flows. However, the agreement in many cases is not sufficiently good to consider the methods as satisfactory design or analysis techniques. Additional work is suggested to provide further verification and improvements. GRA

N80-11074# Polar Research Lab., Inc., Santa Barbara, Calif.
FEASIBILITY TESTS OF USE OF THE TRI TURBO-3 AIRCRAFT FOR ARCTIC AXBT DROPS Interim Report
B. M. Buck 25 Jul. 1979 17 p
(Contract N00014-79-C-0002; RR03205011)
(AD-A073159; PRL-TR-19) Avail: NTIS HC A02/MF A01 CSCL 08/10

Field feasibility trials of the new Arctic Tri Turbo-3 Aircraft were conducted as part of ONR's Arctic East Program in the Eurasian Basin. One of these trials was a test of its usefulness to collect temperature profiling data in the Greenland-Svalbard Strait in support of underwater acoustics studies. This report describes the aircraft facilities, dropping techniques and results of trial drops. GRA

N80-11075# Kuhn (Richard E.), Newport News, Va.
HEIGHT OF SPRAY PRODUCED BY VERTICAL TAKEOFF AND LANDING (VTOL) AIRCRAFT
Richard E. Kuhn Apr. 1979 30 p refs
(Contract N00167-78-M-2599)
(AD-A073099; DTNSRDC/ASED-79/04) Avail: NTIS HC A03/MF A01 CSCL 01/2

The flow phenomenon involved in the production of spray by a vertical takeoff and landing aircraft hovering over smooth water is examined, and a method for predicting spray height is developed from a correlation of the limited amount of large-scale data available. The method is limited to conditions where the spray height does not exceed the nozzle or rotor height and includes VTOL concepts ranging from the helicopter to jet VTOL'S. Application of the method shows that the spray height is primarily dependent on the operating weight of the aircraft and is only slightly dependent on the disk loading. GRA

N80-11076# Pisa Univ. (Italy). Ist. di Aeronautica.
A METHOD FOR EVALUATING AIRCRAFT TAKE-OFF PERFORMANCE [UN METODO PER LA VALUTAZIONE DELLE PRESTAZIONI DEI VELIVOLI]
C. Casarosa, A. Mancino, and N. Motroni Jun. 1978 74 p refs In ITALIAN; ENGLISH summary
(Contracts CNR-76-00442.07; CNR-76-01620.07)
(Rapt-1663; AIA-78-1) Avail: NTIS HC A04/MF A01

A theoretical method and a computation program for aircraft takeoff performance evaluation are presented. The method is based on the integration of the center of gravity motion equation and allows for the evaluation of takeoff performance in function of the main aerodynamic and propulsive characteristics of the aircraft as well as of the takeoff procedure used. Performance evaluation in the case of critical engine failure after a critical point is also possible. The method was tried for the takeoff performance evaluation of a typical executive aircraft having two turbojet engines. Theoretical results were compared with experimental ones and good agreement is shown. Results show that the use of this computerized simulation method for determining aircraft to airfield compatibility is reliable.
Author (ESA)

N80-11077# National Swedish Road and Traffic Research Inst., Linkoeping.
AIRCRAFT ROLLING RESISTANCE IN LOOSE, DRY SNOW: A THEORETICAL ANALYSIS
Mats Lidstroem 1979 40 p refs Sponsored by Natl. Swed. Civil Aviation Admin.
(VTI-173-A) Avail: NTIS HC A03/MF A01

In order to provide data on the rolling resistance of aircraft in dry, loose snow, measurements using an aircraft tire and an ASTM-tire were carried out. In order to be able to predict the rolling resistance as a function of aircraft speed, static wheel load, snow density, and snow depth, with the presented measurements as base, a complementary theoretical predictive model was derived. Finally, after comparing theory and practical measurements, a formula for the determination of the rolling resistance as a function of aircraft and snow parameters is suggested.
Author (ESA)

N80-11078# National Transportation Policy Study Commission, Washington, D. C.
NEW AIRCRAFT TECHNOLOGY: REPORT ON THE FARNBOROUGH INTERNATIONAL AIR SHOW
Samuel Colwell Aug. 1979 12 p
(PB-298345/0; NTPSC-WP-79/06) Avail: NTIS HC A02/MF A01 CSCL 01C

Aircraft displayed at the air show are described with emphasis on those that are likely to have significant impact on nonmilitary aviation market for the rest of the century. Categories of aircraft considered include commercial, light transport, general aviation, and helicopters. The Mountbatten (SR.N4) MK.3 hovercraft is also discussed. Of particular interest is the number of STOL aircraft and the reduced noise characteristics.
A.R.H.

N80-11024 Allerton Press, Inc., New York, N. Y.
SELECTING THE PASSENGER AIRPLANE FUSELAGE
Yu. N. Egorov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 114-116 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 135-138
(For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation and 35 Instrumentation and Photography.*

N80-11079*# Old Dominion Univ., Norfolk, Va.
AVIONICS: PROJECTIONS FOR CIVIL AVIATION, 1995-2000
Griffith J. McRee (Old Dominion Univ.), Russell E. Lueg (Ala. Univ., Tuscaloosa, Ala.), Patricia A. Carlson, ed. (Rose-Hulman Inst. of Tech.), Yearn H. Choi (Jackson State Univ.), John Barrett Crittenden (Va. Polytech. Inst. and State Univ.), Jeffrey C. Dozier (Coll. of William and Mary), Robert M. Eastman (Missouri-Columbia Univ.), Jerry W. Gravander, ed. (Clarkson Coll. of Tech.), Andrew Hargrove (Hampton Inst.), Alvin E. Keaton, ed. (New Mexico State Univ.) et al Sep. 1979 205 p refs Sponsored by NASA
(NASA-CR-159035) Avail: NTIS HC A10/MF A01 CSCL 10D

A view of the 1995-2000 civil aviation avionics system is summarized. Descriptions of the scenarios considered, the avionics technologies, the 1995-2000 avionics system, and an evaluation of the impacts are presented. Recommendations are also presented.
R.E.S.

N80-11080# Semcor, Inc., Moorestown, N. J.
AVIONIC SYSTEM ARCHITECTURE INVESTIGATION (AVSAR II)
D. Davino, R. Mersday, M. Minnich, R. Noble, and L. Sorenson 20 Mar. 1979 246 p
(Contract DAAB07-78-C-2445; DA Proj. 1L1-62202-AH-85)
(AD-A071743) Avail: NTIS HC A11/MF A01 CSCL 09/2

The objective of the Avionic System Architecture Investigation (AVSAR II) was to investigate the extent to which multiplex technology and integrated control/display techniques could be applied to the AH-1S Night Cobra (Step 4). The primary purpose of the study was to determine if the integration of a multiplex data bus system would have a significant impact on aircraft system weight. Secondary objectives were to determine whether a reduction of crew workload and a reduction of cockpit real estate requirements could be effected through implementation of the new architecture. This technical report describes the system analysis, system definition, and system integration considerations that resulted in a Step 4 Night Cobra avionic system with integrated controls/displays and a multiplex data bus.
GRA

N80-11081# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
CONTROL STRATEGIES FOR COMPLEX SYSTEMS FOR USE IN AEROSPACE AVIONICS Interim Report, 1 Jul. 1978 - 30 Jun. 1979
Jose B. Cruz, Jr. 10 Jul. 1979 17 p refs
(Grant AF-AFOSR-3633-78; AF Proj. 2304)
(AD-A072540; AFOSR-79-0907TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

This interim scientific report highlights the results on a research project devoted to the development of concepts and methodology for the analysis and synthesis of control strategies for complex systems. The results are documented in journal articles, meeting papers, and technical reports cited in the list of publications. The results are summarized under the following headings: Sensitivity adaptive feedback with estimation redistribution, sensitivity reducing compensators using observers, design of optimal systems with low sensitivity to small time delays, output feedback compensator design, zeros of multivariable systems, optimal control of a class of singularly perturbed nonlinear systems, Newton-Lyapunov design for a class of nonlinear regulator problems variable structure model following control systems, and robust control system design.
GRA

N80-11082# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
A FAULT TOLERANCE ASSESSMENT OF DAIS Final Report, Sep. 1978 - Mar. 1979
Walter L. Heimerdinger and Karl. M. Fant Mar. 1979 128 p refs
(Contract F33615-77-C-1232; AF Proj. 2003)
(AD-A072450; HONEYWELL-79SRC13; AFAL-TR-79-1007)
Avail: NTIS HC A07/MF A01 CSCL 09/2

A functional/graphical approach is used to assess the fault tolerance of the Digital Avionics Information System (DAIS), a real-time federated multicomputer digital avionics system. Two separate assessments are made; first, the functional/graphical approach is used to assess the fault tolerance of the DAIS architecture, then the utility of the functional/graphical approach itself is considered. The functional/graphical approach used has two complementary aspects; a functional characterization

of fault phenomena, and a graphical approach to the representation of system behavior, both for normal operations and in response to faults. The graphical representation used is based on the LOGOS system description schema, which uses two associated graphs, a control graph and a data graph, to represent a process or activity. The study extends earlier functional/graphical studies of individual, isolated fault tolerance mechanisms, to the assessment of a complex large scale digital system. The assessment begins by modeling top level DAIS control functions and includes DAIS master executive functions and top level functions from a potential DAIS application. GRA

N80-11083# Arinc Research Corp., Annapolis, Md.
AVIONICS MASTER PLAN DATA BASE MECHANIZATION ARCHITECTURE
J. Maquire and M. Berger Jun. 1979 56 p
(Contract F33657-79-C-0475)
(AD-A071545; PUBL-1743-01-1-1963) Avail: NTIS HC A04/MF A01 CSCL 05/1

This report addressed the development of the architecture for mechanizing the program tracking system used by the Deputy for Avionics Control ASD/AX in the Avionics Master Plan AMP preparation and in the avionics control function. The effort described is to be utilized by the ASD Data Processing facility ADP in its coding and implementation of the AMP data base storage and retrieval program on the DEC PDP 11T60 computer. GRA

N80-11084# Army Aeromedical Research Lab., Fort Rucker, Ala.
IN-FLIGHT PERFORMANCE EVALUATION OF EXPERIMENTAL INFORMATION Final Report
Michael Lees, Michael G. Sanders, Raymond T. Burden, Jr., and Kent A. Kimball May 1979 27 p refs
(DA Proj. 3E7-62773-A-819)
(AD-A071701; USAARL-79-8) Avail: NTIS HC A03/MF A01 CSCL 01/4

The objective of this investigation was to evaluate a method of displaying information which permits rapid transmission of flight data to the operator under three viewing conditions: (1) day flights with the unaided eye, (2) night flights with the unaided eye, and (3) night flights using the AN/PVS-5 night vision goggles (40 deg field of view focused at infinity). Information obtained from the analyses of aviator performance data demonstrated the potential of presenting flight information to the aircrew via prototype displays for all viewing modes. GRA

N80-11085# Tactical Air Command, Langley AFB, Va.
F-4 RADAR ALTIMETER AURAL WARNING
29 Jun. 1979 4 p
(AD-A072870) Avail: NTIS HC A02/MF A01 CSCL 01/4

The F-4 radar altimeter has a red warning light that lights up when the aircraft goes below a selected altitude. This light is small and will not attract the pilot's attention if it is not in his field of view. Numerous accidents have occurred in which aircraft have struck the ground in level terrain when the mission required primarily straight and level flight. It has been postulated that an aural warning supplied by the radar altimeter would have alerted the aircrew in sufficient time to avoid contact with the ground. GRA

N80-11086# Battelle Inst., Frankfurt am Main (West Germany). Dept. of Economics and Social Science.
DEVELOPMENT OF STARTING POINTS FOR A SELECTIVE SUPPORT PROGRAM FOR CIVIL AVIONICS TECHNOLOGIES Final Report
Eberhard Hellermann and Herbert Weinreich Bonn Bundesmin. fuer Forsch. u. Technol. Jun. 1978 251 p refs In GERMAN; ENGLISH summary
(Contract BMFT-LFF-7605)
(BMFT-FB-W-78-21) Avail: NTIS HC A12/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 52.50

The technological and economic structure of the German civil avionics industry was analyzed. The study was mainly designed to answer the question of whether and in which area the technological development of the German civil avionics industry can be meaningfully furthered by systematic government support. The relevant information was obtained in interviews with experts in Germany and other countries. A Delphi survey and a workshop served to assess and check the plausibility of the results obtained. A catalog of 11 technologies recommended for public assistance under a support program of the Federal German Ministry of Research and Technology is given.
Author (ESA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.*

N80-11087*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFLUENCE OF COOLANT TUBE CURVATURE ON FILM COOLING EFFECTIVENESS AS DETECTED BY INFRARED IMAGERY
S. Stephen Papell, Robert W. Graham, and Richard P. Cageao Washington Nov. 1979 18 p refs
(NASA-TP-1546; E-066) Avail: NTIS HC A02/MF A01 CSCL 21E

Thermal film cooling footprints observed by infrared imagery from straight, curved, and looped coolant tube geometries are compared. It was hypothesized that the differences in secondary flow and in the turbulence structure of flow through these three tubes should influence the mixing properties between the coolant and the main stream. A flow visualization tunnel, an infrared camera and detector, and a Hilsch tube were employed to test the hypothesis. A.W.H.

N80-11088# Air Force Logistics Command, Wright-Patterson AFB, Ohio. Directorate of Management scienties.
OPPORTUNISTIC MAINTENANCE ENGINE SIMULATION MODEL: OMENS 2 Final Report
John L. Madden, Philip A. Persensky, Virginia L. Williamson, and Robert A. Novak Jun. 1979 133 p
(AD-A072516; AFLC/XRS-79-137-1) Avail: NTIS HC A08/MF A01 CSCL 21/5

This model simulates the operation of a single engine through a very long period of future time. In operating over this extended period, the engine must be removed for repair from time to time. Repairs become necessary on the engine when one of the modules fails prematurely or whenever it requires replacement of an internal life-limited part. The model tracks all the engine removals and all replacements of each module and offending life-limited part through future simulated time. Records are kept through simulated time of the number of removals and the reasons for removal for each module and for the engine. Reasons for removal include (1) premature failure of one or more parts, (2) reaching the scheduled operating time limit, or (3) being screened out due to the opportunistic maintenance policy. The model also computes maintenance, pipeline, parts costs, and transportation costs associated with the forecasted removals and aggregates the costs for any desired life cycle period (in years) to aid in selecting that optimal maintenance policy which produces the least total cost. GRA

N80-11089# Naval Air Test Center, Patuxent River, Md. Air Vehicle Technology Dept.
SIMULATED MISSION ENDURANCE TEST (SMET) FOR AN AIRCRAFT ENGINE TO BE USED IN A FIGHTER/ATTACK ROLE Final Report
S. M. Cote and J. L. Birkler 23 Apr. 1979 130 p refs
(AD-A071907; NADC-77051-30) Avail: NTIS HC A07/MF A01 CSCL 21/5

A 750 hour simulated mission endurance test (SMET) cycle which will closely represent the expected in-service engine duty cycle for the F18 power plant has been developed. The test cycle evolved from an extensive investigation of Navy and Marine

fleet engine operating conditions experienced in fighter and attack aircraft during shorebased and carrier operations. The test cycles reflect power lever movements that are an order of magnitude greater than originally thought, and incorporate a representative distribution of time at intermediate and augmented power. It is concluded that this SMET will aid the overall development process to substantiate the suitability of a new engine for service introduction. GRA

N80-11090# Ford Motor Co., Dearborn, Mich.
BRITTLE MATERIALS DESIGN, HIGH TEMPERATURE GAS TURBINE Interim Report, 30 Sep. 1977 - 31 Mar. 1978
Arthur F. Mclean and John R. Secord Army Materials and Research Center, Watertown, Mass. Army Materials and Research Center, Watertown, Mass. May 1979 77 p refs
(Contracts DAAG46-71-C-0162; ARPA Order 1849)
(AD-A071750; AMMRC TR-79-12) Avail: NTIS HC A05/MF A01 CSCL 21/5

Modifications in the procedure for hot spin testing ceramic rotors resulted in several changes. Of twenty-five rotors being proposed for hot testing, ten were inspected by dye-penetrant methods, dimensionally inspected, and curvic coupling contact patterns checked. Five have now completed hot testing; six are ready for test, and the remainder are in processing. Four ceramic turbine rotors and one rotor hub were qualified for hot testing in the cold spin pit at 55,000 rpm, and three rotors and two rotor hubs were qualified to 70,000 rpm. Blades were lost on all rotors qualified to 70,000 rpm because of gross flaws in the blade cross section. From four to eleven blades per rotor were lost in qualification testing. Six rotors was subjected to a twenty-five hour durability test in the hot spin test rig at 50,000 rpm and 1800 F rim temperature. Four rotors completed the test and two failed during acceleration to test speed. In several instances, post test rotor inspection revealed presence of curvic tooth cracking after disassembly from the test shaft. One of the successful rotors was operated an additional 175 hours to complete the objective of 200 hours at 1800 F rim temperature over a simulated duty cycle speed schedule. GRA

N80-11091# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
BLADED DISK DYNAMIC RESPONSE Final Report, 1 Sep. 1977 - 1 Sep. 1978
J. L. Bearden Wright-Patterson AFB, Ohio AFAPL Feb. 1979 41 p refs
(Contract F33615-77-C-2093; AF Proj. 2307)
(AD-A071975; PWA-FR-10576; AFAPL-TR-79-2002) Avail: NTIS HC A03/MF A01 CSCL 21/5

The feasibility of applying an optical derotator system to conduct dynamic structural analysis of a rotating/vibrating fully bladed gas turbine rotor assembly in a controlled spin pit facility was investigated. Interferometric holograms using pulsed laser holography were constructed for various assembly modes of vibration at assembly rotational velocities up to 835.6 rad/sec (8000 rpm). Results of this investigation are encouraging, although a large bias fringe density, resulting from a plexiglass panel in the optical train, made definitive analysis of the resultant mode shapes difficult. GRA

N80-11092# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
THE EFFECT OF INTERBLADE PHASE ANGLE AND SOLIDITY ON THE TIME VARIANT AERODYNAMIC RESPONSE OF A COMPRESSOR STATOR Interim Report, 1 May 1978 - 1 May 1979
R. R. Allran Jun. 1979 55 p
(Contract F49620-78-C-0070; AF Proj. 2307)
(AD-A071878; DDA-EDR-9930; AFOSR-79-0853TR) Avail: NTIS HC A04/MF A01 CSCL 21/5

The overall objective of this experimental program was to quantify the effects of the reduced frequency as well as the interblade phase angle and associated solidity variations on the fundamental time-variant aerodynamics relevant to forced response in turbomachinery. This was accomplished in a large, low speed, single-stage research compressor which permitted variation of the interblade phase angle and solidity by varying the number of rotor to stator blades. A single value of interblade phase angle, 36 degrees and a corresponding value of solidity of .758, the aerodynamically induced fluctuating surface pressure distributions on the downstream vane row, with the primary source of excitation being the upstream rotor wakes, were measured over a wide range of compressor operating conditions. The individual vane surface data were investigated to determine the effect of interblade phase angle and solidity on the overall unsteady pressure magnitude as well as to determine the dynamic pressure coefficient and aerodynamic phase lag for the unsteady pressure differential across the vanes. The unsteady pressure differential data were correlated with predictions from a state-of-the-art flat plate cascade transverse gust analysis. GRA

N80-11093# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
DESIGN AND PERFORMANCE EVALUATION OF SUPER-CRITICAL AIRFOILS FOR AXIAL FLOW COMPRESSORS Final Report
H. E. Stephens and D. E. Hobbs Jun. 1979 45 p refs
(Contract N00019-77-C-0546)
(AD-A071206; PWA-FR-11455) Avail: NTIS HC A03/MF A01 CSCL 20/4

Pratt Whitney Aircraft has developed an analytical design procedure for producing supercritical cascade airfoils satisfying practical aerodynamic and structural requirements. The purpose of this research is to demonstrate the potential for substantial efficiency improvements in compressor stages incorporating these airfoil designs. The midspan section of a fan exit stator was selected for the design application. An airfoil was designed, fabricated, and tested in a transonic cascade tunnel. Test conditions were varied over a wide range of inlet flow angles and inlet Mach numbers to determine design and off-design performance. Test point information included inlet and exit conditions and airfoil surface pressure distribution. GRA

N80-11094# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF AN EJECTOR POWERED ENGINE SIMULATOR AT TRANSONIC MACH NUMBERS Final Report
C. E. Robinson AEDC Jul. 1979 248 p refs Sponsored by the Air Force
(AD-A071607; AEDC-TR-78-69) Avail: NTIS HC A11/MF A01 CSCL 20/4

An experimental program was conducted to evaluate an air-driven ejector for use as a turbo-engine simulator in wind tunnel testing. The use of an engine simulator will provide the capability to simultaneously simulate inlet and afterbody flow fields of a turbo-powered vehicle. The ejector-powered engine simulator (EPES) was fitted to the right-wing nacelle of a 0.06 scale B-1 aircraft model. The B-1 model was chosen for the investigation because of the availability for comparisons of inlet and nozzle afterbody data previously obtained in the Arnold Engineering Development Center (AEDC) Propulsion Wind Tunnel Facility Propulsion Wind Tunnel (16T) using conventional test techniques. A limited amount of flight data from the B-1 flight to wind tunnel correlation program was also available to aid in determining the effectiveness of the EPES as a wind tunnel test tool. GRA

N80-11095# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
THE USE OF THE MAURER FACTOR FOR ESTIMATING THE COST OF A TURBINE ENGINE IN THE EARLY STAGES OF DEVELOPMENT Final Report, Jun. 1978 - Jun. 1979
Charles W. Barrett, Jr. and Michael J. Koenig Jun. 1979 165 p refs
(AD-A073018; AFIT-LSSR-19-79A) Avail: NTIS HC A08/MF A01 CSCL 14/1

Military managers are faced with increasing systems costs. One area where this increasing cost is especially true is in the acquisition of aircraft weapon systems. A driving factor in the aircraft cost is the turbine engine, and therefore, acquisition managers have been tasked with developing cost estimating methods that will more accurately predict turbine engine cost. At present, several parametric costing models available are briefly discussed in this report. However, the primary objective of this report, is to evaluate a costing technique used extensively by the Navy--the Maurer Factor (MF) technique. The MF technique is a parametric costing technique based on the materials in a turbine engine. The report includes the following: (a) a detailed

description of the MF technique; (b) a validation of the MF technique; (c) the development of an estimated MF (EMF) model using engine performance parameters; and (d) statistical analysis and validation of the EMF models. GRA

N80-11096# Defence Research Information Centre, Orpington (England).
ON THE DEVELOPMENT OF THE RB 199
Mariano Gubitosi London Dec. 1978 22 p Transl. into ENGLISH from Rivista Aeron. (Rome), v. 54, no. 3, May-Jun. 1978 p 32-39
(DRIC-Trans-5429; BR67500) Avail: NTIS HC A02/MF A01

The development of the RB 199 engine as a tailor-made solution for the MRCA 'Tornado' project is discussed. Operational requirements, such as very high thrust under combat flight conditions and low fuel consumption under other flight conditions, are considered. Design technological alternatives, principally thrust/weight ratio, and as built characteristics are examined. The triple-shaft configuration is treated in light of the performance principles of a jet engine. Among functional choices, afterburn, the double flow solution, and the setting of the by-pass ratio are particularly detailed. Finally, the RB 199 turbofan is described and a short synopsis of the design evolution of this engine is given. Author (ESA)

N80-11006 Allerton Press, Inc., New York, N. Y.
STATISTICAL DIAGNOSTICS AIRCRAFT ENGINES
Yu. V. Kozhevnikov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 20-25 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 30-35 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11007 Allerton Press, Inc., New York, N. Y.
OPTIMAL THERMOGASDYNAMIC DESIGN OF GAS TURBINE ENGINES USING ELEMENT PROTOTYPES, 1
Yu. V. Kozhevnikov, V. O. Borovik, V. S. Ivanov, V. A. Talyzin, I. N. Agliullin, and Yu. V. Maluzov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 26-32 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 36-43 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc. 150 Fifth Ave., N.Y. 10011; $45.00

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-11097*# Systems Technology, Inc., Mountain View, Calif.
A COMPILATION AND ANALYSIS OF HELICOPTER HANDLING QUALITIES DATA. VOLUME 1: DATA COMPILATION Report, Sep. 1978 - Feb. 1979
Robert K. Heffley, Wayne F. Jewell, John M. Lehman, and Richard A. VanWinkle Aug. 1979 387 p refs
(Contract NAS2-9344)
(NASA-CR-3144; TR-1087-1) Avail: NTIS HC A17/MF A01 CSCL 01C

A collection of basic descriptive data, stability derivatives and transfer functions for six degrees of freedom, quasi-static model is introduced. The data are arranged in a common, compact format for each of the five helicopters represented. The vehicles studied include the BO-105, AH-1h, and the CH53D. R.C.T.

N80-11098*# Boeing Commercial Airplane Co., Seattle, Wash.
LINEAR SYSTEMS ANALYSIS PROGRAM, L224(QR). VOLUME 2: SUPPLEMENTAL SYSTEM DESIGN AND MAINTENANCE DOCUMENT Final Report, May 1975 - May 1977
K. W. Heidergott Nov. 1979 142 p refs
(Contract NAS1-13918)
(NASA-CR-2862; D6-44471) Avail: NTIS HC A07/MF A01 CSCL 01C

The computer program known as QR is described. Classical control systems analysis and synthesis (root locus, time response, and frequency response) can be performed using this program. Programming details of the QR program are presented. R.C.T.

N80-11099# Naval Surface Weapons Center, White Oak, Md.
INEQUALITIES AND APPROXIMATION WITH APPLICATIONS TO VSTOL AIRCRAFT
William W. Hager and John W. Wingate 3 Dec. 1978 24 p refs
(AD-A071807; NSWC/WOL/TR-78-210) Avail: NTIS HC A02/MF A01 CSCL 01/3

A class of inequalities are discussed that are related to the following topics: (1) error estimates for variational inequality and optimal control approximation; (2) stability for mathematical programs; and (3) solution regularity for optimal control problems. These results are used to study the error in the semidual method for approximating the solution to optimal control problems. The application of the semidual to optimize VSTOL flight trajectories is discussed. GRA

N80-11100# California Univ., Los Angeles. School of Engineering and Applied Science.
ENTROPHY ANALYSIS OF FEEDBACK FLIGHT DYNAMIC CONTROL SYSTEMS Final Report, May 1977-May 1978
Henry Lawrence Weidemann and C. T. Leondes Jan. 1979 165 p refs
(Contract F33615-77-C-3013; AF Proj. 2307)
(AD-A072259; AFFDL-TR-78-123) Avail: NTIS HC A08/MF A01 CSCL 01/2

This report is a study of the application of the entropy function of Information Theory to the analysis of sampled data systems so characteristic of the evolving and important field of digital flight control, including multimode systems. The systems studied are both feed-forward and feedback with the emphasis placed on the regulator problem. The feature common to all the configurations is the presence of a sensor which measures the input signal and which has an output that is usually some random function of the input. For the purposes of the analysis it is convenient to describe the behavior of the sensor by its Sensor Channel Transmittance, which is defined as the mutual information between the input and output of the measuring device. This quantity is not independent of the properties of the input signal; however, in any given problem it need only be calculated once. This research is important because it imbeds the control problem in the communication problem and clearly demonstrates the manner in which the information handling capability of the system elements limits performance, and is, therefore, of considerable potential significance to advanced flight dynamic systems. GRA

N80-11101# Rodden (William P.), La Canada, Calif.
AERO-SERVO-ELASTIC STABILITY ANALYSIS Final Report, 6 Apr. 1976 - 21 Jul. 1977
William P. Rodden, Mildred R. Zeilman, and John M. Powers, Jr. Apr. 1979 205 p refs
(Contract N00019-76-C-0346)
(AD-A072797) Avail: NTIS HC A19/MF A01 CSCL 14/2

A general matrix formulation of the aero-servo-elastic stability problem is presented based on the British method of flutter analysis. The analysis applies to the closed-loop system, and the digital computer program (MPASES) developed to perform the analysis is described. An application is made to a typical air-to-air missile with three feedback loops. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-11102*# Virginia Univ., Charlottesville.
EXPERIMENTAL FEASIBILITY STUDY OF THE APPLICA-

TION OF MAGNETIC SUSPENSION TECHNIQUES TO LARGE-SCALE AERODYNAMIC TEST FACILITIES
R. N. Zapata, Robert R. Humphris, and Karl C. Henderson 1975 10 p refs Submitted for publication
(Grants NGR-47-005-029; NGR-47-005-110; NGR-47-005-112; NsG-1010)
(NASA-CR-146761) Avail: NTIS HC A02/MF A01 CSCL 14B

Based on the premises that magnetic suspension techniques can play a useful role in large scale aerodynamic testing, and that superconductor technology offers the only practical hope for building large scale magnetic suspensions, an all-superconductor 3-component magnetic suspension and balance facility was built as a prototype and tested successfully. Quantitative extrapolations of design and performance characteristics of this prototype system to larger systems compatible with existing and planned high Reynolds number facilities at Langley Research Center were made and show that this experimental technique should be particularly attractive when used in conjunction with large cryogenic wind tunnels. A.R.H.

N80-11103*# San Jose State Univ., Calif. Dept. of Psychology.
PERCEPTION AND PERFORMANCE IN FLIGHT SIMULATORS: THE CONTRIBUTION OF VESTIBULAR, VISUAL, AND AUDITORY INFORMATION Final Report
Oct. 1979 20 p refs
(Grant NsG-2289)
(NASA-CR-162129) Avail: NTIS HC A02/MF A01 CSCL 14B

The pilot's perception and performance in flight simulators is examined. The areas investigated include: vestibular stimulation, flight management and man cockpit information interfacing, and visual perception in flight simulation. The effects of higher levels of rotary acceleration on response time to constant acceleration, tracking performance, and thresholds for angular acceleration are examined. Areas of flight management examined are cockpit display of traffic information, work load, synthetic speech call outs during the landing phase of flight, perceptual factors in the use of a microwave landing system, automatic speech recognition, automation of aircraft operation, and total simulation of flight training. A.W.H.

N80-11104*# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
PRELIMINARY INVESTIGATIONS OF DESIGN PHILOSOPHIES AND FEATURES APPLICABLE TO LARGE MAGNETIC SUSPENSION AND BALANCE SYSTEMS
C. P. Britcher Nov. 1979 35 p refs
(Grant NsG-7523)
(NASA-CR-162433) Avail: NTIS HC A03/MF A01 CSCL 14B

The technology which is required to allow the principles of magnetic suspension and balance systems (MSBS) to be applied to the high Reynolds number transonic testing of aircraft models is examined. A test facility is presented as comprising a pressurized transonic cryogenic wind tunnel, with the MSBS providing full six degree of freedom control. The electro-magnets which are superconducting and fed from quiet, bipolar power supplies are examined. A model control system having some self adaptive characteristics is discussed. A.W.H.

N80-11105# Systems Technology, Inc., Hawthorne, Calif.
MANNED ENGINEERING FLIGHT SIMULATION VALIDATION, PART 2: SOFTWARE USER'S GUIDE Final Report, Aug. 1977 - Nov. 1978
Susan A. Riedel Feb. 1979 57 p
(Contract F33615-77-C-2065(8))
(AD-A071395; STI-TR-1110-2; AFFDL-TR-78-192-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 14/2

The goal of this research is to establish an orderly, relatively simple method for optimizing the presentation of motion cues in moving base simulations. This is accomplished via choice of the drive logic parameters for a given simulator and flying task. The method developed here is based upon use of motion fidelity criteria. It has been applied to optimize the LAMARS motion base drive logic parameters for an air-to-ground scenario. The methods and procedures can be applied for any given motion base and any desired scenario. This report describes the FORTRAN computer program used for evaluating and optimizing motion base drive logic. GRA

N80-11106# Little (Arthur D.), Inc., Cambridge, Mass.
SYSTEMS ANALYSIS OF ARCTIC FUELS DISPENSING EQUIPMENT Final Report, 1 Jan. - 30 Jun. 1979
Donald B. Rosenfield, Edgar A. Gilbert, III, and John S. Howland 30 Jun. 1979 174 p
(Contract DAAK70-77-D-0024)
(AD-A071815; ADL-80260-18) Avail: NTIS HC A08/MF A01 CSCL 21/4

A systems analysis was performed to evaluate military fuel dispensing systems for arctic applications. The present systems, the Forward Area Refueling Equipment (FARE) and Fuels System Supply Point (FSSP), encounter problems in the areas because engines fail to start and elastomerics become brittle at temperatures of -60 F. The systems analysis consisted of two phases of evaluating and scoring system attributes for numerous combinations of systems concepts and components. The systems with the highest evaluations were the basic designs with gas turbine drives, state-of-the-art elastometrics, and either state-of-the-art batteries or a compressed gas start. It was also concluded that additional development should be undertaken in the area of cold weather elastomerics. GRA

N80-11107# Naval Aerospace Medical Research Lab., Pensacola, Fla.
DOCUMENTATION AND USER'S MANUAL FOR THE VISUAL DETECTION SIMULATOR (VDS) Interim Report
Julie A. Hopson Apr. 1979 348 p
(ZF51524004)
(AD-A070487; NAMRL-SR-79-2) Avail: NTIS HC A15/MF A01 CSCL 05/9

The Visual Detection Simulator (VDS) is comprised of three individual subsystems: A Link GAT-1 trainer, a projection system, and a PDP 8/e controller. These systems have been custom interfaced to permit the study of target acquisition in a simulated in-flight environment. The purpose of this report is to provide an operational and maintenance manual for the VDS system. Subsystems and their interrelationships are described, and operational procedures for the total system are provided. Computer programs for the simulator operation, data transfer, and the maintenance, and testing procedures are included. GRA

N80-11108# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE MEASUREMENT OF FILM COOLING EFFECTIVENESS IN SHORT DURATION WIND TUNNELS
J-P. Ville, D. Cunat, and B. E. Richards Dec. 1978 59 p refs
(VKI-TN-127) Avail: NTIS HC A04/MF A01

A method to measure adiabatic wall effectiveness and the associated heat transfer coefficient of a film cooling system under simulated gas turbine conditions in a short duration wind tunnel is described. This method is based on the measurement of heat transfer rates under different wall and coolant temperature conditions and the definition of a linear relationship between a heat transfer coefficient, h, based on the main stream recovery temperature, and a non dimensional temperature theta. The measurements on a film cooled flat plate at Mach 0.6, main stream temperature of 385 K, and unit Reynolds number of 24 million for a range of wall to main stream temperature ratios of from 0.70 to 0.93 and a range of coolant to mainstream temperature ratios between 0.73 and 0.93 with a coolant relative mass flow from 0.6 to 1.4 confirm the linearity of the h (theta) relation. This demonstrates that a short duration facility can provide good film cooling data with this method. Author (ESA)

N80-11109# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
DATA ACQUISITION SYSTEMS FOR THE HYPERSONIC GUN AND NITROGEN WIND TUNNELS
R. P. Bartlett, J. Davis, and J. K. Harvey Feb. 1979 32 p refs
(Contract AT/2037/084)
(IC-Aero-79-03) Avail: NTIS HC A03/MF A01

A digital system that links the Nitrogen Tunnel and the No. 2 Gun Tunnel to a time shared minicomputer system was

developed. The prime requirement for both facilities was data acquisition and processing, but in the case of the Nitrogen Tunnel it has also been possible to make on-line calculations and to present the processed data to the operator while the facility is running. A high speed digital data acquisition system was also commissioned to make detailed time resolved measurements in the Gun Tunnel which has a steady running time of a few milliseconds. Author (ESA)

N80-11110# Fondazione Ugo Bordoni, Rome (Italy).
SURVEILLANCE AND COMMUNICATION SYSTEMS USING MOBILE MEDIA ON THE AIRPORT SURFACE [SISTEMI DI SORVEGLIANZA E DI COMUNICAZIONE CON MEZZI MOBILI SULLA SUPERFICIE AEROPORTUALE]
Tullio Corzani (Trieste Univ., Italy) and Gabriele Falciasecca (Bologna Univ.) Sep. 1978 10 p refs In ITALIAN Presented at 79th A.E.I. Ann. Reunion, Catanzaro, Italy, Sep. 1978 Sponsored by CNR
(FUB-13-1978) Avail: NTIS HC A02/MF A01

The problems of an airport surface traffic control system developed in Italy are examined. A selection among possible systems is discussed, starting with solutions which use primary radar (now being adopted in many airports) and arriving at a completely automated system for surveillance and control of the airport surface, based on the use of secondary surveillance radar equipment on the ground. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

N80-11111*# General Dynamics/Convair, San Diego, Calif.
SPACE CONSTRUCTION AUTOMATED FABRICATION EXPERIMENT DEFINITION STUDY. (SCAFEDS), PART 3. VOLUME 1: EXECUTIVE SUMMARY Final Report
29 Jun. 1979 33 p
(Contract NAS9-15310)
(NASA-CR-160345; CASD-ASP-78-016-Pt-3-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22A

A range of tasks focused on a baseline system concept is discussed. A beam builder concept developed to produce a triangular beam is discussed. Beam elements used laminated graphite and glass composite strip material with external surface coatings are described. A.W.H.

N80-11112*# Battelle Columbus Labs., Ohio.
EVALUATION CRITERIA FOR COMMERCIALLY ORIENTED MATERIALS PROCESSING IN SPACE PROPOSALS Final Report
W. F. Moore and J. R. McDowell Jan. 1979 58 p
(Contract NASw-2800)
(NASA-CR-162437; BCL-OA-TFR-78-5) Avail: NTIS HC A04/MF A01 CSCL 22A

An approach and criteria for evaluating NASA funded experiments and demonstrations which have commercial potential were developed. Methods for insuring quick initial screening of commercial proposals are presented. Recommendations are given for modifying the current evaluation approach. New criteria for evaluating commercially orientated materials processing in space (MPS) proposals are introduced. The process for selection of qualified individuals to evaluate the phases of this approach and criteria is considered and guidelines are set for its implementation. R.C.T.

N80-11113# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Hauptabteilung Raumfahrtprogramme.
FEASIBILITY STUDY FOR SELECTED SPACELAB EXPERIMENTS CONDUCTED IN THE DISCIPLINES OF EARTH OBSERVATION AND METEOROLOGY Final Report
Hansgeorg Francois, Hans Werner Killian, Gerhard Bommas, Gerd Steffen, vonArved Breitenstein, Bernd Kunkel, and Peter Mueller Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 103 p refs In GERMAN; ENGLISH summary Prepared in cooperation with MBB, Munich
(Contracts BMFT-WRT-1075; DFVLR-BPT-01-QS-395) (BMFT-FB-W-77-46) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 21,40

For five remote earth sensing and meteorological experiments proposed for the first SPACELAB mission the conceptual designs and feasibility of these payloads were studied. The results are used to support planning of hardware development. The five experiments selected require equipment such as a multi-channel scanning radiometer, a spectral albedometer, a trace gas analyzer, a multi-channel polarimeter, and a two-frequency microwave scatterometer. The feasibility analyses cover mission planning, system design, SPACELAB interfaces, and development planning. The results clearly show that even for the first SPACELAB mission it is feasible to develop and qualify these selected experiments. Author (ESA)

N80-11114# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Freiburg (West Germany). Inst. fuer Physikalische Weltraumforschung.
USE OF SPACELAB FOR THE SOLUTION OF TERRESTRIAL PLASMA RESEARCH PROBLEMS Final Report
Rainer Kist and Karl Rawer Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1978 65 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1076; DFVLR-BPT-01-QV-296) (BMFT-FB-W-78-08) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 13,45

A representative review of the problems in plasma physics is given. The main aims and problems of laboratory plasma physics are discussed in more detail. A few examples are chosen to demonstrate the potential of Spacelab plasma physics experiments to achieve these goals and help solve these problems. Candidates for plasma physical experiments on Spacelab include studies of excitation and propagation of electromagnetic and electrostatic waves in plasmas; processes and effects due to the interaction of a beam of charged particles with plasmas; processes and effects due to the interaction of strong electromagnetic wave fields with plasmas; production, properties, and consequences of instable plasma states; structure and dynamics of wakes behind bodies moving with respect to the plasma; and plasma diagnostic measuring methods. It is recommended that the use of the specific opportunities afforded by Spacelab for plasma research should be optimized by implementing activities of precursing and accompanying research with suitable laboratory plasma facilities. Author (ESA)

N80-11115# Siemens A.G., Munich (West Germany).
FEASIBILITY STUDY FOR THE SPACELAB USER PROGRAM. MEASUREMENT OF TERRESTRIAL NOISE, RADIO CONTROL Final Report
Reinhard Bredow, Anton Brunner, Dieter Lovis, Theodor Schwierz, Peter Kreutzer, and Rolf Stiefel Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 221 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Std. Elec. Lorenz AG
(Contracts BMFT-WRT-1076; DFVLR-BPT-01-QV-616) (BMFT-FB-W-78-14) Avail: NTIS HC A10/MF A10; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 46,20

The feasibility of a 90 minute orbiter for scanning terrestrial natural noise (primary noise) and man made noise (secondary noise) was studied. The data are intended for use in compiling a noise map. Both are to be scanned by the 90 minute orbiter especially for the purpose of registrating a noise map. The frequency range to be scanned in the proposed experiment extends from 225 to 1000 MHz. The local scanning is handled by a wide angle antenna along with a narrow beam antenna with reflector size of 10 by 7 m and an area of resolution of about 18 to 70 km. The frequency scanning procedure is carried out by quickly switching extremely spectral pure synthesizers which control the quick amplitude amplification stages of the receiver belonging to the antenna concerned. The data processing system built around a microprocessor controls the sequence of the experiment as well as acquisition, processing, and storage of the picked up data. The incoming data rate will be 150 to 350 kbits depending on the chosen frequency resolution. Author (ESA)

N80-11116# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
PLANNING SYNTHESIS FOR SPACELAB PROJECTS IN COMMUNICATION AND NAVIGATION Final Report
Hans J. Albrecht Oct. 1978 89 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1076; DFVLR-BPT-01-QV-097)
(BMFT-FB-W-78-30) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 18.50

Considering the present state of the art as well as current research work and developmental trends in communication and navigation, an analysis of Spacelab projects in this discipline is presented. An evaluation of experiment proposals submitted within the Federal Republic of Germany is given. As a synthesis of scientific planning activities, criteria of research relevancy, including trend analysis, application-oriented project results, and cost effectiveness are considered. Projects reviewed deal with electromagnetic wave propagation, modulation and bandwith, integrated communication systems, navigation systems, monitoring terrestrial parameters, and equipment technology in space. International coordination is reported and system oriented recommendations as well as a comprehensive bibliography are given. Author (ESA)

N80-11117# Swedish Board for Space Activities, Solna.
SWEDISH SPACE ACTIVITIES DURING 1978 Annual Report
11 May 1979 10 p refs
Avail: NTIS HC A02/MF A01

A build-up of the level of remote sensing activities in Sweden is reported. Meteorological, communication, and navigation applications are cited. National scientific space programs include magnetospheric and ionospheric physics, study of the upper atmosphere, astrophysics, and material sciences. Swedish involvement in various satellite projects, such as the International Sun-Earth Explorer (ISEE) satellite, GEOS 1 and GEOS 2 as well as the International Ultraviolet Explorer (IUE) satellite, is also reported. Sweden conducts an extensive sounding rocket program and activities at the Esrange sounding rocket and balloon range are described. Ground based experiments which involve, among other activities, satellites tracking are also discussed. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-11118# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
OPTIMUM SHAPE FOR TRANSPIRATION-COOLED NOSE-TIP OF A REENTRY VEHICLE Final Report, Oct. 1974 - Jun. 1978
Kevin E. Yelmgren Nov. 1978 93 p refs
(AF Proj. 2404)
(AD-A072296; AFFDL-TR-78-147) Avail: NTIS HC A05/MF A01 CSCL 16/3

The variations of parameters method was used to determine the optimum nose shape for a reentry vehicle having a transpiration-cooled nosetip (TCNT). Three families of nose shapes were considered - The oblate ellipsoid, the flat face - round shoulder, and the spherical arc - round shoulder. These families are bounded by the flat face - sharp corner at one extreme and the hemisphere at the other extreme. The amount of coolant required by each nose shape during reentry was determined by using a high speed computer to couple the aerodynamic equations with the trajectory equations. The optimum shape is the shape which requires the least amount of coolant for reentry. The flat face - sharp corner shape was found to require the least amount of coolant, about 60 percent less water than the hemisphere. Although the time to impact is longer for the flat face, the smaller surface area and lower heating intensity more than offsets the increased reentry time. The possibility of an optimum flat face height was also investigated; no face height was found that minimized the total heating to the vehicle during reentry. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-11119# Royal Signals and Radar Establishment, Christchurch (England).
THE RSRE SATELLITE COMMUNICATIONS TEST FACILITY
E. H. Thomas Mar. 1978 15 p ref
(RSRE-78008; BR83099) Avail: NTIS HC A02/MF A01

An explanation of the functions of the facility and a list of in-orbit measurement accuracies are presented. The satellite communications test facility essentially consists of a number of satellite communications earth stations connected on-line into a central spacecraft test laboratory and from there into several research and development laboratories. The prime purpose of the facility is to support the development of satellite communications systems. The establishment is engaged in studies of satcoms for various defense purposes. Support to satellite communications projects includes the testing of new types of earth station equipments and sub-systems, and in-orbit testing of spacecraft. Such work includes studies of interference between various signals passing through spacecraft repeaters, diagnosis of fault conditions in the communications sub-systems of orbiting spacecraft, support of inter-operability trials, detailed measurement of transmissions from operational stations, measurement of spacecraft range, and other tasks requiring special expertise. Author (ESA)

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-11120*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
APPLICATION OF IPAD TO MISSILE DESIGN
J. E. Santa and T. R. Whiting Apr. 1974 393 p refs Sponsored in part by Army Missile Command, Redstone Arsenal, Ala.
(Contract NAS1-12436)
(NASA-CR-132671) Avail: NTIS HC A17/MF A01 CSCL 16D

The application of an integrated program for aerospace-vehicle design (IPAD) to the design of a tactical missile is examined. The feasibility of modifying a proposed IPAD system for aircraft design work for use in missile design is evaluated. The tasks, cost, and schedule for the modification are presented. The basic engineering design process is described, explaining how missile design is achieved through iteration of six logical problem solving functions throughout the system studies, preliminary design, and detailed design phases of a new product. Existing computer codes used in various engineering disciplines are evaluated for their applicability to IPAD in missile design. A.W.H.

N80-11121*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY, PHASE 2. Interim Report
9 Jul. 1979 265 p
(Contract NAS9-15636)
(NASA-CR-160377; D180-25381-1) Avail: NTIS HC A12/MF A01 CSCL 22B

A program plan for the Solar Power Satellite Program is presented. The plan includes research, development, and evaluation phase, engineering and development and cost verification phase, prototype construction, and commercialization. Cost estimates and task requirements are given for the following technology areas: (1) solar arrays; (2) thermal engines

and thermal systems; (3) power transmission (to earth); (4) large space structures; (5) materials technology; (6) system control; (7) space construction; (8) space transportation; (9) power distribution, and space environment effects. J.M.S.

N80-11122*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.

SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY, PHASE 2. PART 1: MIDTERM BRIEFING

27 Jun. 1979 543 p

(Contract NAS9-15636)

(NASA-CR-160378; D180-25402-1) Avail: NTIS HC A22/MF A01 CSCL 22B

An overview of the program plan for the Solar Power Satellite Program is given. Progress in the microwave power transmission system is reported. A description is given of the following: (1) launch and recovery site facilities, systems and operations; (2) cargo packaging; (3) earth-to-LEO cargo transportation operations; (4) LEO-to-GEO cargo transportation operations; (5) personnel transportation operations; (6) space vehicles in-space maintenance operations; and (7) SPS maintenance systems and operations. Other topics discussed include GEO base operations, satellite construction operations, intra-base logistics, and GEO base definition. A research and program plan is presented along with cost estimates. J.M.S.

N80-11123*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.

SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY

26 Jul. 1978 161 p Prepared jointly with GE, Schenectady, N.Y. and Grumman, Bethpage, N.Y. and Little (Arthur D.), Boston, Mass. and TRW, Redondo Beach, Calif.

(Contract NAS9-15636)

(NASA-CR-160368; D180-24735-1) Avail: NTIS HC A08/MF A01 CSCL 22B

A synopsis of the study plan for the solar power satellite system is presented. Descriptions of early task progress is reported for the following areas: (1) laser annealing, (2) solid state power amplifiers, (3) rectenna option, (4) construction of an independent electric orbit transfer vehicle, and (5) construction of a 2.5 GW solar power satellite. R.E.S.

N80-11124# Lincoln Lab., Mass. Inst. of Tech., Lexington.

OPTICAL ARTIFICIAL SATELLITE SEARCHES

Laurence G. Taff May 1979 48 p refs

(Contract F19628-78-C-0002; AF Proj. 2128)

(AD-A071248; ETS-44; ESD-TR-79-76) Avail: NTIS HC A03/MF A01 CSCL 17/1

This report presents a summary of the current state of optical artificial satellite searches using two telescopes. A rudimentary presentation of search strategy is given for near-stationary satellites and high inclination satellites. A complete discussion of the astrometric and photometric observing procedures necessary for identification and subsequent reacquisition is also provided. We also include a complete list of the necessary software and the minimum necessary tools that the orbital analyst requires. GRA

N80-11125# Raytheon Co., Bedford, Mass. Missile Systems Div.

MODULAR DIGITAL MISSILE GUIDANCE Technical Report, 1 Jan. - 31 Oct. 1978

Frank J. Langley and John Demetrick 30 Nov. 1978 57 p refs

(Contract N00014-75-C-0549)

(AD-A072544; BR11013; ONR-CR233-052-5) Avail: NTIS HC A04/MF A01 CSCL 09/2

The rapidly developing microprocessor technology poses serious standardization problems for the user, particularly the military, where logistics support costs are significant over the life cycle of tactical systems. Whereas standard interface busses are now in existence e.g., (S-100, Intel Multibus, National Microbus, Motorola Microbus, European 'MUBUS'), no two busses are the same. To provide freedom of choice in microcomputer components throughout a system life cycle, a programmable microbus interface module (MIM) using common programmable control elements (PCEs), such as that described in this report, absorbs the interface irregularities of commercial microprocessors, memory and input-output (I/O) modules, thereby allowing the selection of components based on performance, support software, cost and other driving factors. GRA

N80-11126# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.

DISTRIBUTED SOURCE GENERATION FOR RF ENVIRONMENTAL MODELING FOR HARDWARE-IN-THE-LOOP MISSILE GUIDANCE SIMULATION

F. M. Belrose and D. A. McPherson 12 Mar. 1979 19 p

(AD-A072927; DRDMI-T-79-37) Avail: NTIS HC A02/MF A01 CSCL 17/7

The basic simulation philosophy of the Advanced Simulation Center (ASC) is to incorporate as much missile hardware as possible into simulation. Errors associated with modeling nonlinear devices are thus avoided while increasing credibility of the simulation. However, this places a special burden on the simulators to display a realistic and comprehensive environment during the simulations because the seekers are stimulated at their operating wavelengths. The seeker is the more difficult subsystem to model properly, and if it is to form valid responses to environmental stimuli, then the stimuli must portray the correct time, space and frequency characteristics of the target, clutter, ECM and multipath. GRA

N80-11127# California Univ., Livermore. Lawrence Livermore Lab.

ANALYSIS OF BERYLLIUM PARTS FOR COSMOS 954

J. E. Hanafee 25 Oct. 1978 47 p refs

(Contract W-7405-eng-48)

(UCRL-52597) Avail: NTIS HC A03/MF A01

Operation Morning Light, conducted to search for the reactor core of Cosmos 954, the nuclear powered Soviet satellite that crashed in the northwest territories of Canada in late January 1978 is discussed. The geometry, condition, microstructure, and possible fabrication history of these beryllium parts are discussed. DOE

N80-11128# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Aerospace Dept.

KINETIC HEATING OF HIGH SPEED MISSILES

B. E. Richards Jan. 1979 23 p refs Presented at AGARD Lecture Series on 'Missile Aerodyn.', Ankara, Rome, and Rhode Saint Genese, Belgium, Mar. 1979

(Preprint-1975-5) Avail: NTIS HC A02/MF A01

Kinetic heating as related to high speed tactical missiles is reviewed. The aspects considered are the design problem, the prediction of heating in attached and separated flows, measurements on configurations in flight and in wind tunnels, ground simulation obtained of flows over models, and the measurement of kinetic heating. Experience is generally obtained from studies in related areas such as high speed aircraft, reentry vehicles, etc., rather than on tactical missiles since little information appears to be available on this application. Because of the wide coverage of the field, a list of references is provided as a guide to papers giving more refined details. Author (ESA)

N80-11129# Technische Universitaet, Brunswick (West Germany). Inst. fuer Nachrichtentechnik.

DESIGN AND OPERATION OF THE SEARCH-COIL MAGNETOMETER EXPERIMENT ON THE SOLAR PROBE HELIOS *Final Report*

Guenther Dehmel and Fritz Manfred Neubauer Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 76 p refs In GERMAN; ENGLISH summary

(Contracts BMFT-WRT-0107; GfW-01-H-3004)

(BMFT-FB-W-77-25) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 15.75

Scientific objectives, functioning, electronic and mechanical design, as well as operation of the HELIOS search-coil magnetometer experiment which investigates the magnetic component of electromagnetic waves in the solar wind from 0.3 to 1.0 AU are described. By means of its wave form channel (WFC) the rapid variations in the magnetic field are measured in 3 orthogonal directions from 4 to 128 Hz. The Spectrum Analyzer (SPA) observes power spectral density and peak values on the field components in the eliptic plane and perpendicular to it in the range from 4.7 to 2200 Hz. After amplification they are band-limited by low pass filters in the WFC and analog integrators

give output signals for digitization and transmission. The integrators in the second flight unit were replaced by amplifiers. The SPA data is automatically adapted to the telemetry capacity enabling a continuous transmission. Author (ESA)

N80-11130# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
SIMULATION TESTS OF AN ATTITUDE CONTROL SYSTEM WITH STAGGERED PULSES ON A SATELLITE MOTION STIMULATOR Final Report
Reinhold Stapf and Klaus Becker Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 82 p refs In GERMAN; ENGLISH summary Prepared in cooperation with ERNO Raumfahrttech. GmbH
(Contracts BMFT-WRT-2073; DFVLR-BPT-01-AO-074)
(BMFT-FB-W-78-29) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 17.25

An attitude control system with staggered pulses was tested in a physical simulation on a three-axis air bearing table using specially designed sensors and cold gas thrusters. The system behavior under real conditions was determined, critical modes were searched and analyzed, and the limits of the system were found. The system and the experimental setup are described. Results show that the system is suitable for acquisition and coarse attitude control as well as for attitude control in the range of arc seconds. Author (ESA)

N80-11131# Royal Aircraft Establishment, Farnborough (England).
REVISED TABLE OF EARTH SATELLITES, VOLUME 2: 1969 TO 1973
J. A. Pilkington, D. G. King-Hele, H. Hiller, and Doreen M. C. Walker London Jan. 1979 180 p refs Sponsored by Procurement Executive, Min. of Defence
(RAE-TR-79001; BR66975) Avail: NTIS HC A09/MF A01

A list of 559 satellite launches, arranged chronologically, is presented. For each launch, the name and international designation of each instrumented satellite and its associated rocket(s) are given, along with the data of launch, lifetime (actual or estimated), mass, shape, dimensions, and at least one set of orbital parameters. Other fragments associated with a launch are listed without these details. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N80-11132# British Aerospace Dynamics (Space), Stevenage (England). Space Div.
PALLET-ONLY CONFIGURATION IMPROVEMENT STUDY: TECHNICAL SUMMARY REPORT Final Report
B. Collins, comp. London 1979 95 p refs
(Contract ESA-3608/78)
(RAE-TP-7717; ESA-CR(P)-1210) Avail: NTIS HC A05/MF A01

A data base from which potential modifications of the Spacelab baseline pallet-only configuration can be selected for the development of an improved version is presented. Summaries of working papers on 21 improvement candidates are included, classified by categories refering to short pallets, hardpoints, miscellaneous structural, mounting surfaces, and systems.
Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N80-11133# Sandia Labs., Livermore, Calif. Post Development Testing Div.
DESIGN OF A MULTICHANNEL FM/FM TELEMETRY SYSTEM FOR HIGH G ENVIRONMENT APPLICATIONS
L. D. Humpreys Jan. 1979 79 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8042) Avail: NTIS HC A05/MF A01

Design criteria are presented for a multichannel telemetry system to provide data for the reliability assessment of a major electromechanical system to be used in a high g flight environment. Procedures are included for designing an FM/FM telemetry system capable of optimum performance when operating close to the signal-to-noise threshold of the receiver. The theory supporting this design is also presented, along with the theory of the associated pre-emphasis of multichannel FM signals. The application of the design procedure imposed by this philisophy is illustrated by inclusion of a telemetry design to meet the electrical, environmental, and mechanical requirements of an actual telemetry system under development. Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N80-11134*# Grumman Aerospace Corp., Bethpage, N.Y.
DESIGN AND FABRICATION OF ELEVON COVE THERMAL PROTECTION SYSTEMS FOR AEROSPACE VEHICLES
Progress Report, Apr. 1978 - Jul. 1977
Angelo Varisco, Albin Borysewicz, and Willie Wolter May 1979 77 p
(Contract NAS1-14112)
(NASA-CR-159055; Rept-1764-79) Avail: NTIS HC A05/MF A01 CSCL 22B

The design study of a flightweight, effective, reuseable seal for use along the elevon cove of shuttle-type reentry and hypersonic cruise vehicles is presented. The study deals primarily with membrane seals, both metallic and non-metallic. This type of seal spans the cove gap between the wing and elevon, and does not depend on spring tension to maintain contact along a flexing wing span. Technical requirements and criteria were generally derived from the space shuttle and utilized for seal design. R.E.S.

N80-11135# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Space Development Dept.
INSTRUMENTATION DEVELOPED BY THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY FOR NON-APL SPACECRAFT
Nov. 1978 230 p refs
(Contracts N00024-78-C-5384; N00017-72-C-4401)
(AD-A072438; APL/JHU-SDO-4100) Avail: NTIS HC A11/MF A01 CSCL 22/2

Scientific and engineering instrumentation and support equipment developed by the Applied Physics Laboratory of the Johns Hopkins University for non-APL spacecraft since 1960 are described. The descriptions are arranged in chronological order according to experiment and include illustrations and system block diagrams. References and a listing of APL contributions

to space research and technology are included. Instrumentation described includes: Transit-on-Discoverer; Injun Satellite Proton Instrumentation; Magnetic Attitude Control System; Solar Proton Monitors; Doppler Beacon; Orbiting Frog Otolith Experiment; Energetic Particles Experiment; Charged Particle Measurement Experiment; Ultraviolet Spectrometer Experiment; Skylab Experiment M131; Photoelectron Spectrometer; Apollo-Soyuz Ultraviolet Absorption Experiment MA-059; NAVPAC (Navigational Package); Low Energy Charged Particle Experiment (Voyager); Particle Flux Monitor (International Ultraviolet Explorer); and SEASAT-A Instrumentation Radar altimeter, SAR data link; Doppler Beacon, and Laser retroreflector array, geiger telescope, a low energy magnetospheric particular analyzer, a low energy particle telescope, and oculogyral illustration, a polar cap absorption, and a rotating litter chair. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-11136*# Rockwell International Corp., Anaheim, Calif. Strategic Systems Div.

THE 10 TO THE 8TH POWER BIT SOLID STATE SPACECRAFT DATA RECORDER

G. W. Murray, O. D. Bohning, R. Y. Kinoshita, and F. J. Becker Washington NASA Oct. 1979 179 p *refs*
(Contract NAS1-14174)
(NASA-CR-3182; C78-1151.1/201) Avail: NTIS HC A05/MF A01 CSCL 14E

The results are summarized of a program to demonstrate the feasibility of Bubble Domain Memory Technology as a mass memory medium for spacecraft applications. The design, fabrication and test of a partially populated 10 to the 8th power Bit Data Recorder using 100 Kbit serial bubble memory chips is described. Design tradeoffs, design approach and performance are discussed. This effort resulted in a 10 to the 8th power bit recorder with a volume of 858.6 cu in and a weight of 47.2 pounds. The recorder is plug reconfigurable, having the capability of operating as one, two or four independent serial channel recorders or as a single sixteen bit byte parallel input recorder. Data rates up to 1.2 Mb/s in a serial mode and 2.4 Mb/s in a parallel mode may be supported. Fabrication and test of the recorder demonstrated the basic feasibility of Bubble Domain Memory technology for such applications. Test results indicate the need for improvement in memory element operating temperature range and detector performance. R.C.L.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-11137*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

SPECIFIC SPACECRAFT EVALUATION: SPECIAL REPORT

Special Report, 1 Nov. 1977 - 1 Jun. 1978
J. M. Sellen, Jr. 1 Nov. 1978 211 p
(Contract NAS3-21047)
(NASA-CR-159420) Avail: NTIS HC A10/MF A01 CSCL 21H

Charged and neutral particle transport from an 8 cm mercury ion thruster to the surfaces of the P 80-1 spacecraft and to the Teal Ruby sensor and the ECOM-501 sensor of that spacecraft were investigated. Laboratory measurements and analyses were used to examine line-of-sight and nonline-of sight particle transport modes. The recirculation of Hg(+) ions in the magnetic field of the earth was analyzed for spacecraft velocity and Earth magnetic field vector configurations which are expected to occur in near Earth, circular, high inclination orbits. For these magnetic field and orbit conditions and for expected ion release distribution functions, in both angles and energies, the recirculation/reinterception of ions on spacecraft surfaces was evaluated. The refraction of weakly energetic ions in the electric fields of the thruster plasma plume and in the electric fields between this plasma plume and the material boundaries of the thruster, the thruster sputter shield, and the various spacecraft surfaces were examined. The neutral particle transport modes of interest were identified as sputtered metal atoms from the thruster beam shield. Results, conclusions, and future considerations are presented. R.C.T.

N80-11138# Science Applications, Inc., La Jolla, Calif.

AN EXPERIMENTAL APPARATUS FOR INVESTIGATING THE KINETIC REACTIONS IN SOLID ROCKET NOZZLES

Final Report, 2 Jun. 1977 - 30 Mar. 1979
J. P. Pope and R. B. Dirling Jun. 1979 62 p
(Contract F04611-77-C-0047)
(AD-A071318; AFRPL-TR-79-17) Avail: NTIS HC A04/MF A01 CSCL 21/8

The present interest in carbon composite and bulk polycrystalline graphite materials for solid propellant rocket nozzles has occurred, primarily due to the poor thermostructural performance of conventional pyrolytic graphite throat inserts as propellant flame temperature is increased. Circumvention of this problem has necessitated complex, multi-component nozzle configurations which are not only costly to fabricate, but inherently less reliable than an integral design. Composite materials, in particular carbon-carbon composites, offer the potential of considerable improvement in manufacturing, reliability and performance attributes compared to pyrolytic graphite. However, their ablation response in the primarily rate-controlled ablation regime of rocket nozzles is poorly understood. At the present time their ablation response is being assessed using the same techniques previously applied to non-porous pyrolytic graphite; e.g., evaluation of the kinetic coefficients from measurements of recession rate in arc plasma generator (APG) facilities. GRA

N80-11139# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab Section.

LGM-30B, STAGE 2 DISSECTED MOTORS Semiannual Test Report

Mar. 1979 144 p
(AD-A071402; MANCP-414(79)) Avail: NTIS HC A07/MF A01 CSCL 21/8

This report contains test data from propellant and case bond materials from Minuteman Stage 2 dissected motors. Testing was performed in accordance with Service Engineering General Test Directive GTD-1 Dissect dated 28 June 1974 and Project M83248C. Statistical analysis includes data from both inner (ANP 2864) and outer (ANP 2862) propellant. Test samples were obtained from two dissected motors this test period. Data obtained from these two motors have been combined with earlier test data from these same two motors and from a third motor. Linear regression plots using unique symbols to identify the three motors were used to indicate trends. Most of the propellant specimens were prepared and tested in the axial orientation, that is, parallel to the longitudinal axis of the motor. GRA

N80-11140# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

MEASUREMENTS OF TURBULENCE PARAMETERS IN A ROCKET ENGINE EXHAUST USING A LASER CROSSED BEAM CORRELATION TECHNIQUE

Gautam T. Kalghatgi Jan. 1979 26 p *refs*
(AASU-340) Avail: NTIS HC A03/MF A01

The laser crossed beam correlation method in its Schlieren mode was used to measure the root mean square value of the fluctuation in density gradient along the flow direction, the integral scale in the transverse direction, convection velocity, and a form of time and length scales in the flow direction in the axisymmetric exhaust plume of a stationary liquid fuel rocket engine. Under certain restrictive assumptions, the root mean square value of the density fluctuation is also inferred. These measurements were made at different radial positions at four different axial stations

and are consistent with each other as well as with expectations based on previously published knowledge of axisymmetric turbulent jets. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N80-11141*# *Technochemie G.m.b.H., Heidelberg (West Germany).*
DEVELOPMENT AND FABRICATION OF BISMALEIMIDE-GRAPHITE COMPOSITES *Final Report*
H. D. Stenzenberger, M. Herzog, W. Roemer, and R. Scheiblich 23 Aug. 1979 49 p
(Contract NASw-3027)
(NASA-CR-152324; Rept-7908) Avail: NTIS HC A03/MF A01 CSCL 11D

The successful fabrication of high temperature resistant composites depends mainly on the processability of the resin binder matrix. For two new bismaleimide type resins the processing of graphite fabric prepregs to composites is described. One resin coded M 751 has to be processed from N-Methylpyrrolidone, the other resin evaluated is a so-called hot melt solvent-less system. Commercial T300/3000 Graphite fabrics were used as reinforcement. The M 751 - Resin is a press grade material and laminates are therefore moulded in high pressure conditions (400 N/sq cm). The solvent-less resin system H 795 is an autoclave grade material and can be cured at 40 N/sq cm. The cure cycles for both the press grade and the autoclave grade material (Fiberite W 143 fabric prepregs) are provided and the mechanical properties of laminates at low (23 C) and high (232 C) temperatures were measured. For comparison, the neat resin flexural properties are also presented. The water absorption for the neat resins and the graphite fabric laminates after a 1000 hour period was evaluated. Author

N80-11142*# *National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.*
CORROSION RESISTANT THERMAL BARRIER COATING *Patent Application*
S. R. Levine, R. A. Miller, and P. E. Hodge, inventors (to NASA)
Filed 31 Oct. 1979 8 p
(NASA-Case-LEW-13086-1; US-Patent-Appl-SN-089779) Avail: NTIS HC A02/MF A01 CSCL 11D

A thermal barrier coating system was developed to protect the surfaces of metal components, gas turbines, and other heat engine parts that are exposed to fuels contaminated with metallic impurities which are normally corrosive to previously known metallic coatings. The coating system includes a metal alloy bond coating, the alloy containing nickel, cobalt, iron, or a combination of these metals. The system also includes a corrosion resistant thermal barrier oxide coating containing at least one alkaline earth silicate. The preferred oxides are calcium silicate, barium silicate, magnesium silicate, or a combination of these silicates. NASA

N80-11143*# *National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.*
MICROMECHANICS OF INTRAPLY HYBRID COMPOSITES: ELASTIC AND THERMAL PROPERTIES
C. C. Chamis and J. H. Sinclair Washington 1979 19 p refs
Presented at the Winter Ann. Meeting of the Am. Soc. of Mech. Engr., New York, 2-7 Dec. 1979
(NASA-TM-79253; E-164) Avail: NTIS HC A02/MF A01 CSCL 11D

Composite micromechanics are used to derive equations for predicting the elastic and thermal properties of unidirectional intraply hybrid composites. The results predicted using these equations are compared with those predicted using approximate equations based on the rule of mixtures, linear laminate theory, finite element analysis and limited experimental data. The comparisons for three different intraply hybrids indicate that all four methods predict approximately the same elastic properties and are in good agreement with measured data. The micromechanics equations and linear laminate theory predict about the same values for thermal expansion coefficients. The micromechanics equations predict through-the-thickness properties which are in good agreement with the finite element results. Author

N80-11144*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
TENSILE AND FLEXURAL STRENGTH OF NON-GRAPHITIC SUPERHYBRID COMPOSITES: PREDICTIONS AND COMPARISONS
C. C. Chamis, J. H. Sinclair, and R. F. Lark 1979 27 p refs
Presented at 11th Natl. Tech. Conf., Boston, Mass., 13-15 Nov. 1979; sponsored by Soc. for the Advancement of Material and Process Engr.
(NASA-TM-79276; E-203) Avail: NTIS HC A03/MF A01 CSCL 11D

Equations are presented and described which can be used to predict bounds on the tensile and flexural strengths of nongraphitic superhybrid (NGSH) composites. These equations are derived by taking into account the measured stress-strain behavior, the lamination residual stresses and the sequence of events leading to fracture. The required input for using these equations includes constituents, properties (elastic and strength), NGSH elastic properties, cure temperature, and ply stress influence coefficients. Results predicted by these equations are in reasonably good agreement with measured data for strength and for the apparent knees in the nonlinear stress-strain curve. The lower bound values are conservative compared to measured data. These equations are relatively simple and are suitable for use in the preliminary design and initial sizing of structural components made from NGSH composites. Author

N80-11145*# *National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.*
DYNAMIC RESPONSE OF DAMAGED ANGLEPLIED FIBER COMPOSITES
C. C. Chamis, J. H. Sinclair, and R. F. Lark 1979 17 p refs
Presented at the Winter Ann. Meeting of the Am. Soc. of Mech. Engr., New York, 2-7 Dec. 1979
(NASA-TM-79281; E-182) Avail: NTIS HC A02/MF A01 CSCL 11D

The effects of low level damage induced by monotonic load, cyclic load and/or residual stresses on the vibration frequencies and damping factors of fiber composite angleplied laminates were investigated. Two different composite systems were studied - low modulus fiber and ultra high modulus fiber composites. The results obtained show that the frequencies and damping factors of angleplied laminates made from low modulus fiber composites are sensitive to low level damage while those made from ultra high modulus composites are not. Vibration tests may not be sufficiently sensitive to assess concentrated local damage in angleplied laminates. Dynamic response determined from low-velocity impact coupled with the Fast Fourier Transform and packaged in a minicomputer can be a convenient procedure for assessing low-level damage. A.R.H.

N80-11148*# Materials Sciences Corp., Blue Bell, Pa.
DEVELOPMENT OF A REALISTIC STRESS ANALYSIS FOR FATIGUE ANALYSIS OF NOTCHED COMPOSITE LAMINATES
E. A. Humphreys and B. Walter Rosen May 1979 90 p refs
(Contract NAS1-15411)
(NASA-CR-159119; MSC-TFR-1005/0206) Avail: NTIS HC A05/MF A01 CSCL 11D

A finite element stress analysis which consists of a membrane and interlaminar shear spring analysis was developed. This approach was utilized in order to model physically realistic failure mechanisms while maintaining a high degree of computational economy. The accuracy of the stress analysis predictions is

verified through comparisons with other solutions to the composite laminate edge effect problem. The stress analysis model was incorporated into an existing fatigue analysis methodology and the entire procedure computerized. A fatigue analysis is performed upon a square laminated composite plate with a circular central hole. A complete description and users guide for the computer code FLAC (Fatigue of Laminated Composites) is included as an appendix. A.R.H.

N80-11147# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

CLASSICAL ANALYSES OF LAMINATED BIMODULUS COMPOSITE-MATERIAL PLATES

Charles W. Bert Jul. 1979 42 p refs

(Contract N00014-78-C-0647)

(AD-A072276; OU-AMNE-79-10) Avail: NTIS HC A03/MF A01 CSCL 20/11

A differential-equation formulation is presented for the equations governing the small-deflection elastic behavior of thin plates laminated of anisotropic bimodulus materials (which have different elastic stiffnesses depending upon the sign of the fiber-direction strains). As a basis for comparative evaluation of a finite-element formulation presented in Technical Report No. 3 of the contract, exact closed-form solutions are presented for two cross-ply-laminated plate problems: (1) a freely supported rectangular plate subjected to a sinusoidally distributed normal pressure, and (2) a fully clamped elliptic plate subjected to uniform normal pressure. For the special case of isotropic bimodulus material, simplified approximate solutions are deduced from the exact ones. Good agreement is obtained among the two solutions presented here, as well as with numerical results existing in the literature for special cases and with the finite-element results. Also, for the first time, a closed-form solution is presented for a rectangular plate arbitrarily laminated of anisotropic ordinary (not bimodulus) material. GRA

N80-11148# Army Material Development And Readiness Command, Alexandria, Va.

ENGINEERING DESIGN HANDBOOK. JOINING OF ADVANCED COMPOSITES

Andrew Devine Mar. 1979 147 p refs

(AD-A072362; DARCOM-P-706-316) Avail: NTIS HC A07/MF A01 CSCL 13/8

This handbook should serve as a guide to designers concerned with the technology associated with the joining of advanced composites. It deals with basic joint design practice as well as with those practices specific to composite joining. Tabulated and graphical representations of joint property data obtained on both bonded and mechanically fastened composites are presented. These data can be used by designers to test the degree of conservatism in calculated joint properties for their composite joint designs and hopefully will impart the necessary degree of confidence or wariness in the early design stages where alterations can be made most economically. It is hoped that the diversity of joint possibilities and the magnitude of the joint strength properties reported will prompt cautious designers of Army materiel to make use of the strength-to-weight advantages offered by advanced composites and also to recognize that the technology is available for practical implementation of these valuable engineering materials. GRA

N80-11149# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.

TRANSIENT HYDROTHERMAL STRESSES IN COMPOSITES: COUPLING OF MOISTURE AND HEAT WITH TEMPERATURE VARYING DIFFUSIVITY Final Report

G. C. Sih and M. T. Shih Mar. 1979 67 p refs

(Contract DAAG46-78-C-0014; DA Proj. 8X3-63304-D-215)

(AD-A072613; AMMRC-TR-79-14) Avail: NTIS HC A04/MF A01 CSCL 11/4

The influence of coupled diffusion of heat and moisture on the transient stresses in a composite is investigated analytically, where the moisture diffusion coefficient is taken to be temperature dependent, while the thermal diffusion coefficient is kept constant. A study of the coupled diffusion equations were made by a finite-difference scheme allowing for time-dependent changes in the humidity and temperature of the environment. The appropriate transient boundary conditions are specified on the surfaces of an infinite plate. Numerical calculations were carried out for the T300/5208 graphite fiber-reinforced epoxy matrix composite, in which the nonuniformity of moisture and temperature is evaluated for sudden changes in the surface moisture and/or temperature. The coupling effect between temperature and moisture is found to be most significant when the plate undergoes a sudden change in surface temperature while the surface moisture concentration is held constant. The present findings indicate that the stresses due to coupling can deviate from the uncoupled results anywhere from 20 to 80 percent depending on the surface temperature gradient. GRA

N80-11150# Army Materials and Mechanics Research Center, Watertown, Mass.

HPLC MONITORING OF GRAPHITE-EPOXY PREPREG AGING Final Report

Gary L. Hagnauer, Julia M. Murray, and Beverley M. Bowse May 1979 23 p ref

(DA Proj. 1L1-61102-AH-42)

(AD-A072294; AMMRC-TR-79-33) Avail: NTIS HC A02/MF A01 CSCL 11/4

A method using high performance liquid chromatography has been developed for the quality control of graphite-epoxy prepregs. The method may be applied both as a standard test method in Military Specifications and as a method for process control. The method is used to monitor compositional changes as the prepreg ages at -13 C, 22 C, and 49 C. Chemical changes in the prepreg are correlated with aging time and process acceptability. GRA

N80-11151# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.

ANALYTICAL AND EXPERIMENTAL EVALUATION OF TWO DESIGNS FOR A GRAPHITE/EPOXY ANTENNA FEED TRUSS FOR A COMMUNICATIONS SATELLITE Final Report, Jun. 1977 - Mar. 1978

Oscar Orringer, John F. McCarthy, Jr., Michael Weinreich, and Alexander Harris Jun. 1978 332 p

(Contract F33615-77-C-3083; AF Proj. 69CW)

(AD-A072484; CSR-TR-78-1; AFFDL-TR-78-78) Avail: NTIS HC A15/MF A01 CSCL 11/4

Two final candidate configurations for a communications satellite antenna feed truss are studied to determine which concept is better suited to the application. Both candidates are designed with graphite/epoxy tubing, and were screened from several other concepts in a preliminary study. The comparative assessment in the present study is based in part on cyclic thermal fatigue design development tests, and in part on dynamic response analyses and finite-element stress analysis. GRA

N80-11152# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

POTENTIAL CHEMICAL SYSTEMS FOR INTRAMOLECULAR CYCLOADDITION CURES Final Report, Sep. 1977 - Sep. 1978

Kreisler S. Y. Lau and Fred E. Arnold May 1979 80 p refs

(AF Proj. 2419)

(AD-A072526; AFML-TR-79-4065) Avail: NTIS HC A05/MF A01 CSCL 11/4

This report is concerned with an in-depth review of the chemical literature from 1957 to 1978 on intramolecular cycloaddition reactions. Selective hydrocarbon and heterohydrocarbon systems were synthesized and evaluated to demonstrate potential for inclusion into IMC curing matrix resins. GRA

N80-11153# Bendix Corp., Kansas City, Mo.

COATING LAMINATED SUBSTRATES Final Report

G. J. Hale Jan. 1979 18 p refs Revised

(Contract EY-76-C-04-0613)

(BDX-613-2062-Rev) Avail: NTIS HC A02/MF A01

The feasibility and development results for coating uniform 6.3 to 12.7 micron m metal films on flat and non-planar Mylar or Kapton laminated substrates are summarized. Four coating techniques (ion plating of aluminum, chemical vapor deposition of aluminum, electroless plating of copper and nickel, and physical vapor deposition of aluminum and aluminum-0.12 weight percent copper) were evaluated. Based on the capability of each process and the resulting properties and structure of these coatings with respect to the requirements, physical vapor deposition was

selected for further development. Processes were developed for depositing aluminum-0.12 weight percent copper alloy from an rf induction vapor source and for depositing pure aluminum from an electron beam gun vapor source. In addition, precision pattern deposition of aluminum from an electron beam gun vapor source was demonstrated for flat Kapton substrates. DOE

N80-11154# Sandia Labs., Albuquerque, N. Mex.
HYGROTHERMAL EFFECTS ON THE MECHANICAL RESPONSE OF KELVAR 49/EPOXY LAMINATES
R. E. Allred 1978 16 p refs Presented at DOE Compatibility Meeting, Golden, Colo., 17 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1362C; Conf-781067) Avail: NTIS HC A02/MF A01

Prior to use in weapon systems, it is necessary to understand the durability of materials in a long term storage environment. The effects of moisture and temperature on the flexural response of Kevlar reinforced epoxy laminates are examined. Temperature or moisture alone do not severely affect the mechanical properties of Kevlar/epoxy; however, strength losses up to 60 percent and modulus losses of 45 percent are seen with saturation moisture contents (5 weight percent) tested at 150 C. Results indicate that filament hygrothermal degradation is the dominant mechanism until moisture solvation depresses the matrix Tg below the test temperature. This is in direct contrast to the majority of high performance resin-matrix composites which exhibit little filament degradation. It is recommended that Kevlar/epoxy components be coated with moisture barriers and that research be conducted on prospective coatings. DOE

N80-11155# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
INFLUENCE OF ENVIRONMENTAL CYCLING ON THE MECHANICAL PROPERTIES OF COMPOSITE MATERIALS, PART 2
Christer L. Lundemo 1978 56 p refs
(Contract FMV-F-FL-82223-75083-07-001)
(FFA-TN-HU-1853.1-Pt-2) Avail: NTIS HC A04/MF A01

Static and fatigue tests (R = 0.1 and R = -1) on carbon fiber reinforced test specimens exposed to temperature and moisture cycling were carried out with the purpose of simulating the real environmental conditions an aircraft may meet during actual use. The investigation comprised regular test specimens and beams built up from carbon fiber prepreg THORNELL 300/NARMCO 5208. The results show that the mechanical properties of the laminate were not influenced by the relatively moderate environmental cycling used. Better fatigue properties were measured for specimens exposed to humid conditions, compared with untreated specimens. This effect is valid only for short times of exposure. Author (ESA)

N80-11156# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
A METHOD FOR CLEANING GUDE-SPACE D96 TAPE
Paris ESA Apr. 1979 12 p
(ESA-PSS-52/QRM-32P-ISSUE-1) Avail: NTIS HC A02/MF A01

A cleaning method which reduces the unacceptably high outgassing rate of Gude-Space D96 in its as received form to a level acceptable for general spacecraft use is described. Gude-Space D96 is a lacing tape consisting of flat braid Dacron fiber impregnated with a special non-corrosive, synthetic-rubber finish. Author (ESA)

N80-11157# New Mexico Univ., Albuquerque. Technology Application Center.
ABLATION AND ABLATIVE MATERIALS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1979
Samuel C. Mauk Aug. 1979 49 p Sponsored in part by NTIS
(NTIS/PS-79/0833/8) Avail: NTIS HC $28.00/MF $28.00
CSCL 11G

Citations of various aspects of ablation and ablative materials are presented. Included are articles covering aerodynamic heating, heat shielding, radiative heat transfer, atmospheric entry, reentry effects, reentry shielding, and reentry vehicles. Ablation of meteorites is covered. Articles concerning various ablative materials are included. Contains 200 citations. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also 77 *Thermodynamics and Statistical Physics*.

N80-11158# Materials Research Labs., Melbourne (Australia).
PERFORMANCE OF A GEL PERMEATION CHROMATOGRAPH AND ITS USEFULNESS IN EXAMINING MIXTURES OF ORGANIC MATERIALS
Ivan Grabovac and Carolyn E. M. Morris Jan. 1979 32 p refs
(MRL-R-725; AR-001-369) Avail: NTIS HC A03/MF A01

The molecular properties of organic materials of defense interest were assessed using a locally designed gel permeation chromatograph fitted with a refractive index (R.I.) detector and an evaporative analyser (E.A.) detector. It was found that with the R.I. detector, the performance is similar to that of other instruments. The response of the E.A. detector was found to depend on a number of operating conditions in an unforeseen manner which limits the usefulness of this detector, however, molecular weight distributions determined with the E.A. detector showed good agreement with the R.I. results. The two detectors were used simultaneously to study a complex mixture of epoxy resins (an aircraft adhesive). A.R.H.

N80-11159# Science Applications, Inc., Woodland Hills, Calif. Combustion Dynamics and Propulsion Technology Div.
MIXING AND COMBUSTION IN HIGH SPEED AIR FLOWS Interim Report, Apr. 1978 - Apr. 1979
P. T. Harsha and R. B. Edelman May 1979 43 p refs
(Contract F49620-77-C-0044; AF Proj. 2308)
(AD-A072642; SAI-79-013-WH; AFOSR-79-0912TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report describes the development of a modular model for the prediction of the performance of sudden expansion burners as a function of the controllable parameters relevant to combustor design. The model is based upon a concept in which the recirculation zone, treated as a stirred reactor, is coupled to a parabolic boundary layer formulation for the flow outside the recirculation zone. Hydrocarbon oxidation kinetics and turbulent kinetic energy models are employed in the model development. In addition to the parabolic-flow and stirred reactor elements, a module representing the fuel injection process has been developed. Results of the application of the modular model to the analysis of cold-flow and reacting-flow dump combustor experimental data are described. GRA

N80-11160# TRW Defense and Space Systems Group, Redondo Beach, Calif.
NONISENTHALPIC INTERACTION OF A PLANAR PREMIXED LAMINAR FLAME WITH A PARALLEL END WALL
G. F. Carrier, F. W. Fendell, W. B. Bush, and P. S. Feldman 1979 28 p refs Presented at Congress and Exposition, Detroit, 26 Feb. - 2 Mar. 1979 Also available as SAE Tech. Ser. no. 790245
(Contracts DAAG29-77-C-0032; E(04-3)-1261)
(AD-A071858; ARO-15048.3-E) Avail: NTIS HC A03/MF A01 CSCL 21/2

The unsteady one-dimensional interaction of a planar flame, propagating through a fuel-lean premixture, with a parallel impervious noncatalytic wall is modeled as a Stefan-type problem incorporating one-step chemistry. Quantitative details concerning retardation of flame speed near an isothermal wall (pertinent to current cooled engines), and concerning acceleration of flame speed near an adiabatic wall (pertinent to proposed engines), are obtained. The time history of unburned hydrocarbon content varies with dimensionless Arrhenius activation energy, the order of the reaction chemistry, and the Lewis-Semenov number. Both

temporally varying pressure, and also nonuniform fuel stratification, are discussed. GRA

N80-11161# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
TITANIUM COMBUSTION RESEARCH PROGRAM AND USER'S MANUAL FOR DECK CCD 1152-0.0 Final Technical Report, 1 Dec. 1975 - 30 Nov. 1978
M. R. Glickstein Wright-Patterson AFB, Ohio AFML Mar. 1979 108 p refs
(Contract F33615-76-C-5041; AF Proj. 7312)
(AD-A072529; PWA-FR-10748; PWA-FR-10755; AFML-TR-79-4001) Avail: NTIS HC A06/MF A01 CSCL 11/6

Titanium and its alloys are known to undergo self-sustained combustion in aerodynamic environments. Energy in several forms, i.e. radiation, frictional heating, or aerodynamic heating can be sufficient to bring the matter to a condition where self-sustained combustion can occur. The phenomenon has been of interest in the laser effects-vulnerability area, and also in aircraft propulsion systems, where titanium alloys are extensively used. GRA

N80-11162# California Inst. of Tech., Pasadena. Chemical Physics Lab.
SIMILARITIES AND DIFFERENCES BETWEEN ELECTRON AND PROTON TRANSFERS AT ELECTRODES AND IN SOLUTION
R. A. Marcus Aug. 1979 13 p refs
(Contract N00014-79-C-0009)
(AD-A073001; Contrib-6006; TR-9) Avail: NTIS HC A02/MF A01 CSCL 07/4

Depending on the initial energies, a proton transfer may proceed either via a saddle-point in a potential energy surface or by crossing from the reactants' to the products' valley before the saddle-point is reached. In the second path the analogy to weak-overlap electron transfers is pointed out. The present study is intended to unify previously divergent viewpoints, by showing how they are special cases of a more general picture. Expressions are obtained for the reaction rate in terms of the properties of the potential energy surface and of other properties of the system, using a hydrogen overvoltage reaction as an example. GRA

N80-11163# Princeton Univ., N. J. Dept. of Chemical Engineering.
A GENERALIZED TIME-TEMPERATURE-TRANSFORMATION PHASE DIAGRAM FOR THERMOSETTING SYSTEMS Technical Report, Sep. 1978 - Sep. 1979
J. K. Gillham Sep. 1979 17 p refs
(Contract N00014-76-C-0200)
(AD-A073007; TR-18) Avail: NTIS HC A02/MF A01 CSCL 07/4

A generalized time-temperature-transformation diagram for the thermosetting process is presented in which the four physical states encountered (i.e., liquid, rubber, ungelled glass and gelled glass) are related to the time and temperature of cure. Gelation and vitrification, as a consequence of quenching morphological development and chemical conversion respectively, are discussed with respect to control of material properties. GRA

N80-11164# New York Univ., N. Y. Dept. of Chemistry.
NUMERICAL DECONVOLUTION OF PHOTOELECTRON SPECTRA OF LIQUIDS
James B. Flanagan Jul. 1979 25 p refs
(Contract N00014-75-C-0397)
(AD-A073087) Avail: NTIS HC A02/MF A01 CSCL 07/4

Described is a method for the deconvolution or removal of spectral broadening due to electron interactions with solvent in liquid-phase ultraviolet photoelectron spectroscopy. Certain differences between this usage of deconvolution and its usual applications in pes are noted. Application of the technique is illustrated using synthetic and experimental data. Possible uses include recovering the 'original' photoemission spectrum before broadening by liquid as well as studying the mechanism of energy loss in solvent. Effects of unscattered electrons on the interpretation of this procedure are discussed. GRA

N80-11165# Ames Lab., Iowa.
X-RAY EXCITED OPTICAL LUMINESCENCE OF POLYNUCLEAR AROMATIC HYDROCARBONS Ph.D. Thesis
Gregory Joseph Oestreich May 1979 164 p refs
(Contract W-7405-eng-82)
(IS-T-856) Avail: NTIS HC A08/MF A01

X-ray excited optical luminescence (XEOL) coupled with time resolved spectroscopy was employed to analyze polynuclear aromatic hydrocarbons (PAH) in n-alkane solvents at 10 K. A pulsed XEOL system which was designed around minicomputer control of a medical X-ray unit was developed. Computer software which generated variable width X-ray pulses, monitored timing reference pulses, controlled data acquisition, and analyzed data was written. Phosphorescence decay constants of several PAHs were determined. Synthetic mixtures of zone refined PAHs were prepared and time resolved with the pulsed XEOL technique. Analytical results obtained from the five component mixtures of PAHs at the part per million level were tabulated. Systematic improvements and further development of the pulsed XEOL method were considered. DOE

N80-11166# Ames Lab., Iowa.
ANALYSIS OF BACKMIXING AND MASS TRANSFER IN SOLVENT EXTRACTION COLUMNS M.S. Thesis
Mahmoud Nazem Jan. 1979 155 p refs
(Contract W-7405-eng-82)
(IS-T-851) Avail: NTIS HC A08/MF A01

The true mass transfer coefficients in backmixed solvent extraction columns are presented. These parameters are of great significance and are very useful in the design and performance evaluation of solvent extraction columns. Several approximate correlations of these parameters as a function of column geometry, operating conditions, and physical properties of the liquid systems involved were developed, and it is possible to use mathematical models in the interpretation and analysis of experimenttal data to determine which correlations appear to be most accurate and easiest to use. The results of the data analysis, together with the best possible estimate of the extraction efficiency were applied to a differential backmixing model to obtain concentration profiles in an extraction column. DOE

N80-11167# Ames Lab., Iowa.
CHROMATOGRAPHY OF METAL IONS WITH A TRIAZINE CHELATING RESIN M.S. Thesis
Wang-Nang Wang May 1979 65 p refs
(Contract W-7405-eng-82)
(IS-T-855) Avail: NTIS HC A04/MF A01

The synthesis, characterization, and some analytical applications of a new triazine resin are described. Separation of group 1B, 2B, 6B, and 7B metal ions from group 8 metal ions is achieved by this PDT-4 resin. Calcium(II) and magnesium(II) are taken up at pH = 6,0.1 M acetate and are eluted at pH = 6,0.1 M sodium nitrate. Copper(II) is retained at pH = 6,0.1 M acetate and pH = 1 hydrochloric acid and is eluted subsequently by 5 M perchloric acid. Molybdenum(VI) is sorbed selectively from 0.1 N sulfuric acid or hydrochloric acid and is eluted in a tight band by 0.1 N sodium hydroxide. Numerous rapid column chromatographic separations are reported using this new resin, including analysis of NBS standard samples. DOE

N80-11168# Oak Ridge National Lab., Tenn.
CHEMICAL STRUCTURES AND REACTIVITIES OF COAL AS AN ORGANIC NATURAL PRODUCT
Clair J. Collins, H. P. Hombach, B. M. Benjamin, W. H. Roark, B. Maxwell, and V. F. Raaen 1979 6 p refs Presented at 177th ACS Natl. Meeting, Honolulu, Hawaii, 1 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790415-25) Avail: NTIS HC A02/MF A01

Some chemical reactions involved in coal liquefaction were studied using carbon 14 labelled compounds and nuclear magnetic resonance. It is concluded that the role of tetralin during coal conversion is (1) to act as a dispersion vehicle; (2) to supply hydrogen radicals, when needed, to trap coal radicals; and (3) in a very minor way to undergo intermolecular reaction with the coal through making and breaking of C-C (and possibly other) bonds. As a result of other experiments it is concluded that to the methods previously employed for breaking bonds in coal molecules and thereby lowering their molecular weights, must now be added the use of solvated-electrons for break-

ing -CH2-CH2-linkages. A possible mechanism for the cleavage of bibenzyl (used as a model compound for coal) is given. DOE

N80-11169# California Univ., Livermore. Lawrence Livermore Lab.
CALCULATION OF CHEMICAL EQUILIBRIUM BETWEEN AQUEOUS SOLUTION AND MINERALS: THE EQ3/6 SOFTWARE PACKAGE
T. J. Wolery 1 Feb. 1979 46 p refs
(Contract W-7405-eng-48)
(UCRL-52658) Avail: NTIS HC A03/MF A01

The newly developed EQ3/6 software package computes equilibrium models of aqueous geochemical systems. The package contains two principal programs: EQ3 performs distribution-of-species calculations for natural water compositions; EQ6 uses the results of EQ3 to predict the consequences of heating and cooling aqueous solutions and of irreversible reaction in rock-water systems. The programs are valuable for studying such phenomena as the formation of ore bodies, scaling and plugging in geothermal development, and the long-term disposal of nuclear waste. EQ3 and EQ6 are compared with such well-known geochemical codes as SOLMINEQ, WATEQ, REDEQL, MINEQL, and PATHI. The data base allows calculations in the temperature interval 0 to 350 C, at either 1 atm-steam saturation pressures or a constant 500 bars. The activity coefficient approximations for aqueous solutes limit modeling to solutions of ionic strength less than about one molal. The mathematical derivations and numerical techniques used in EQ6 are presented in detail. DOE

N80-11170# New York Univ., N. Y. Courant Mathematics and Computing Lab.
LECTURES ON COMBUSTION THEORY
Samuel Z. Burstein, ed., Peter D. Lax, ed., and Gary A. Sod, ed. Sep. 1979 323 p refs
(Contract EY-76-C-02-3077)
(COO-3077-153) Avail: NTIS HC A14/MF A01

Eleven lectures are presented on mathematical aspects of combustion: fluid dynamics, deflagrations and detonations, chemical kinetics, gas flows, combustion instability, flame spread above solids, spark ignition engines, burning rate of coal particles and hydrocarbon oxidation. DOE

N80-11171# Sandia Labs., Livermore, Calif.
LOCAL TURBULENCE PROPERTIES IN FLAMES FROM TIME-AVERAGED RAMAN SPECTROSCOPY MEASUREMENTS
R. E. Setchell 1979 10 p refs Presented at the AIAA Aerospace Sciences Meeting, New Orleans, 15 Jan. 1979
(Contract EY-76-C-04-0789)
(SAND-78-1263C; Conf-790102-1) Avail: NTIS HC A02/MF A01

Local fluctuations in temperature and composition in a turbulent flame are examined through their influence on Raman-scattering measurements of time-averaged flame properties. Using mean temperatures and number densities measured in a hydrogen diffusion flame, two approaches to investigating turbulence properties are examined. In the first, which is restricted to flame condition where fluctuations are fairly small, the variation of measured number density with spectral resolution is used to determine values for particular correlations between fluctuations in number density and temperature. In the second approach the Raman measurements are used to evaluate a particular model for concentration fluctuations. DOE

N80-11172# Ames Lab., Iowa.
PARTIAL MOLAR VOLUMES OF HYDROGEN AND DEUTERIUM IN NIOBIUM AND VANADIUM M.S. Thesis
H. M. Herro Jan. 1979 42 p refs
(Contract W-7405-eng-82)
(IS-T-839) Avail: NTIS HC A03/MF A01

Lattice dilation studies and direct pressure experiments gave comparable values for the partial molar volumes of hydrogen and deuterium in niobium and vanadium. Small isotope effects in the partial molar volume of hydrogen were measured in both metals by the differential isotope method. Hydrogen had a larger partial molar volume than deuterium in niobium, but the reverse was true in vanadium. The isotope effect measured in niobium can be represented as being due to the larger amplitude of vibration of the hydrogen atom than the deuterium atom in the metal lattice. Since hydrogen has a larger mean displacement from the equilibrium position than does deuterium, the average force hydrogen exerts on the metal atoms is greater than the force deuterium exerts. The isotope effect is vanadium is likely a result of anharmonic effects in the lattice and local vibrational modes. DOE

N80-11173# Sandia Labs., Albuquerque, N. Mex.
CHEMICAL VAPOR DEPOSITION OF TiB2 ON GRAPHITE
H. O. Pierson and E. Randich 1978 15 p refs Presented at 6th Conf. on Borons and Borides, Drubzna, Bulgaria, 9 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1794C; Conf-781064-1) Avail: NTIS HC A02/MF A01

An experimental investigation of the coating of graphite with TiB2 by chemical vapor deposition (CVD) using the hydrogen reduction of BCl3 and TiCl4 at 925 C and 1 atm. Reasonable matching of the thermal expansion of TiB2 and graphite was necessary to eliminate cracking. A suitable graphite was POCO DFP-1. Adhesion was improved by having a slightly rough graphite surface. Heat treatment at 2000 C and above resulted in a certain degree of diffusion. No melting or solid phases other than TiB2 and graphite were detected up to 2400 C. The coatings showed no failure when repeatedly submitted to an electron beam pulse of 2 KW/sq cm for 0.8 sec. DOE

N80-11174# Argonne National Lab., Ill.
PHOTO ION MASS SPECTROMETRY AND PHOTOELECTRON SPECTROSCOPY OF HIGH TEMPERATURE VAPORS
J. Berkowitz 1978 25 p refs Presented at 10th Mater. Res. Symp., Gaithersburg, Md., 18 Sep. 1978
(Contract W-31-109-eng-38)
(CONF-780941-4) Avail: NTIS HC A02/MF A01

PIMS and PES were used to study the bond energies and molecular structure in the molecules S2, AlCl, AlCl(+), InCl, TlCl, TlCl+, TlF, Tl2F2, KF, KF(+), LiCl, and LiCl(+). DOE

N80-11175# Argonne National Lab., Ill.
RESONANCE RAMAN SPECTRA OF METAL HALIDE VAPOR COMPLEXES
G. N. Papatheodorou 1978 63 p refs Presented at 10th Mater. Res. Symp., Gaithersburg, Md., 18 Sep. 1978
(Contract W-31-109-eng-38)
(CONF-780941-8) Avail: NTIS HC A04/MF A01

Resonance Raman spectra of complex vapor phase compounds formed by reacting acidic gases (A2X6 = Al2Cl6, Al2Br6, In2Cl6) with metal halides have been measured. Spectra obtained from equilibrium vapor mixtures of A2X6 over solid MX2 (= PdCl2, PdBr2, CuCl2, CoBr2, TlCl2, FeCl2, NiCl2, PtCl2) were a superposition of the A2X6-AX3 bands and in few cases of new resonanceenhanced polarized bands due to MA2X8 and/or MAX5 complexes. At temperatures above 800 deg K, characteristic bands due to MX2(g) (M = Fe, Co, Ni, Cu, Zn) and M2X4(g) (M = Cu) were obeserved. The predominant features of the PdAl2Cl8, CuAl2Cl8, and PdAl2Br6 spectra were three high-intensity, polarized bands which were attributed to the vibrational modes of the complex coupled to the electronic state of the central atom. The spectra of CuAlCl5(g), CuInCl5(g) and Cu2Cl4(g) species showed resonance enhancement of selective fundamentals which were attributed to vibrational modes of trigonally coordinated Cu(II). DOE

N80-11176# California Univ., Berkeley. Lawrence Berkeley Lab.
DEEP LEVEL TRANSIENT SPECTROSCOPY OF HIGH PURITY GERMANIUM DIODES/DETECTORS
Eugene E. Haller, Pearl P. Li, G. Scott Hubbard, and William L. Hansen Oct. 1978 8 p refs Presented at the 1978 IEEE Nucl. Sci. Symp., Washington, D. C., 18-20 Oct. 1978
(Contract W-7405-eng-48)
(LBL-8140; Conf-781033-26) Avail: NTIS HC A02/MF A01

Deep Level Transient Spectroscopy (DLTS) was applied for the first time to high purity germanium p-i-n diodes. Using the correlator technique, a large number of peaks due to acceptor levels in the forbidden band were observed. The levels due to

substitutional copper, to copper-hydrogen complexes and to divacancy-hydrogen defects are examined. Several unknown levels discovered are reported. The results obtained with DLTS are discussed and compared with Hall-effect measurements. DOE

N80-11177# Ames Lab., Iowa.
INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROSCOPY: AN EVALUATION OF THE USE OF NITROGEN-ARGON ADMIXTURES AS PLASMA DISCHARGE ATMOSPHERES M.S. Thesis - Iowa State Univ.
J. C. Zalewski Jan 1979 67 p refs
(Contract W-7405-eng-82)
(IS-T-834)
Avail: NTIS HC A04/MF A01

The effects of the use of nitrogen in either the plasma coolant or aerosol carrier gas flows on the physical and spectrochemical properties of the inductively coupled plasma (ICP) are examined. The plasma operated with nitrogen in the coolant flow and the use of nitrogen in the aerosol carrier gas flow are discussed. The use of nitrogen-argon admixtures in the plasma coolant gas flow is examined. A demountable plasma torch which yielded detection limits for 15 elements and 19 spectral lines that were approximately within a factor of two of those obtained with the torch of fused quartz design is described. DOE

N80-11178# Unilever Research, Vlaardingen (Netherlands).
RHEOLOGY OF CONCENTRATED SUSPENSIONS
M. vandenTempel 1978 10 p refs Revised Submitted for publication
Avail: NTIS HC A02/MF A01

The viscoelastic properties of a flocculated dispersion, at small or slow deformations, are explained in terms of a network model. If the network consists of single particle chains the modulus and strength are proportional to the first power of the volume fraction and weakly dependent on the particle size. More realistic results are now obtained by constructing a network in which the chains consist of preformed aggregates. In several systems, the state of aggregation is found to depend on volume fraction and particle size only through the total particle concentration.
Author (ESA)

N80-11179# IEA Coal Research, London (England).
COMBUSTION OF LOW GRADE COAL
G. F. Morrison Jun. 1978 90 p refs
(ICTIS/TR-02; ISBN-92-9029-016-1) Avail: NTIS HC A05/MF A01

A technical review of the literature is presented in order to assess the increasing extent to which lignite, brown coal, peat, and bituminous shale are combusted for power generation. Although the most common form of combustion in use today, the firing of pulverized low grade coal has presented major operational problems of erosion, corrosion, and fouling of heat exchange equipment. Recent developments in the design of pulverized-coal fired stations are discussed. Fluidized bed combustion has the potential to overcome many of these problems and a brief history of the development of this form of combustion and an assessment of current research is included. One important parameter in the future development of low grade coal combustion is the ability of power stations to comply with national emission standards. The influence of combustion mode on the emission of SO2, NO, and particulates is reviewed. Author (ESA)

N80-11180# IEA Coal Research, London (England).
TRACE ELEMENTS FROM COAL COMBUSTION: ATMOSPHERIC EMISSIONS
M. Y. Lim May 1979 58 p refs
(ICTIS/TR-05; ISBN-92-9029-024-2) Avail: NTIS HC A04/MF A01

The literature relating to trace elements in coal combustion is reviewed from the point of view of atmospheric pollution. Some data on trace element concentration in coal are given and comparisons are made with atmospheric emissions from other sources. Environmental effects and potential health hazards are discussed. Radioactive emissions and trace element accumulation around power plants are also reviewed and types of equipment used for particulate control in power plants are summarized. It is concluded that the importance of coal combustion as a pollutant source depends on what type of regulations are established for emission control and on how well power plants comply with these regulations. Author (ESA)

N80-11181# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
OXIDATION OF GALLIUM ARSENIDE IN A PLASMA MULTIPLE DEVICE. STUDY OF THE MOS STRUCTURES OBTAINED Final Report [OXYDATION DE L'ARSENIURE DE GALLIUM PAR PLASMA EN UTILISANT UN DISPOSITIF MULTIPOLAIRE. ETUDE DES STRUCTURES MOS OBTENUES]
Serge Gourrier, Andrei Mircea, and Francois Simondet Dec. 1978 61 p refs Partly in FRENCH and ENGLISH
(Contract DGRST-77-7-1638)
(LEP-79/62.SME-6B7-A) Avail: NTIS HC A04/MF A01

The oxygen plasma oxidation of GaAs was studied in order to obtain extremely high frequency responses with MOS devices. In the multipole system (magnetic confinement associated with a hot cathode), a homogeneous oxygen plasma of high density 5 x 10 to the 10 power/cu cm) can easily be obtained in a large volume. This system is thus highly convenient for the study of plasma oxidation of GaAs. The electrical properties of the MOS diodes obtained in this way are controlled by interface states, located mostly in the upper half of the band gap where densities in the 10 to the 13 power/sq cm x eV range can be estimated. Despite these interface states the possibility of fabricating MOSFET transistors working mostly in the depletion mode for a higher frequency cut-off still exists. Author (ESA)

N80-11182# Environmental Monitoring and Support Lab., Cincinnati, Ohio.
AN EPA MANUAL FOR ORGANICS ANALYSIS USING GAS CHROMATOGRAPHY-MASS SPECTROMETRY
William L. Budde and James W. Eichelberger Mar. 1979 168 p refs
(PB-297164/6; EPA-600/8-79-006) Avail: NTIS HC A08/MF A01 CSCL 13B

The applicability of gas chromatography-mass spectrometry in environmental analysis is discussed. Included are: sample preparation methods specifically adapted to this measurement technique data processing and interpretation methods, quality control procedures, quantitative analytical techniques, utility software requirements, preventive maintenance recommendations, systematic trouble shooting methods, and a selected bibliography. GRA

N80-11183# Texas A&M Univ., College Station. Dept. of Chemistry.
SURFACE REACTIONS OF OXIDES OF SULFUR
J. H. Lunsford Apr. 1979 42 p refs
(Grant EPA-R-801136)
(PB-297410/3; EPA-600/7-79-088) Avail: NTIS HC A03/MF A01 CSCL 07D

Surface reactions of several sulfur-containing molecules were studied in order to understand the mechanism by which sulfate ions are formed on atmospheric aerosols. At 25 C the heterogeneous oxidation of SO2 by NO2 to sulfuric acid and sulfate ions occurred on hydrated silica and silica-alumina surfaces. The oxidation of SO2 by O2 was undetectably slow on these surfaces; however, the reaction was catalyzed by Mn(+2) ions in a Y-type zeolite in this case the only reaction product was a SO4(-2) species which was strongly bound in the zeolite micropores. Molecule oxygen also reacted with H2S on zeolites and magnesium oxide. The mechanism by which S2O(-) and H2S2(-) are formed on MgO was determined. GRA

N80-11184# Celanese Research Co., Summit, N.J.
HIGH FLUX PBI REVERSE OSMOSIS MEMBRANES FOR DESALINATION AND WATER REUSE Final Report
Marshall Tan and Howard J. Davis 30 Nov. 1978 61 p refs
(Contract DI-14-34-0001-7527)
(PB-297285/9; W79-07571; OWRT-7527(1)) Avail: NTIS HC A04/MF A01 CSCL 07D

High flux, high rejection flat polybenzimidazole (PBI) reverse osmosis membranes were prepared. Membrane film casting and processing parameters were first identified and optimized in small-scale laboratory film casting trials. On the basis of these results, membranes measuring 12 in. by 36 in. and 2.5 mils in thickness were prepared and evaluated in long-term testing at

600 psi and 400 psi with nonchlorinated and chlorinated salt solutions. Two prototype spiral wound modules were fabricated for demonstration purposes. Membrane samples were tested in high pressure test cells against 5000 ppm salt solutions. In long-term testing, a decline in flux was observed, presumably the result of pressure induced compaction. GRA

N80-11184# Research Triangle Inst., Research Triangle Park, N. C.
AMBIENT AIR CARCINOGENIC VAPORS, IMPROVED SAMPLING AND ANALYTICAL TECHNIQUES AND FIELD STUDIES Final Report
Edo D. Pellizzari and John E. Bunch May 1979 341 p refs
(Contract EPA-68-02-2764)
(PB-297832/6; EPA-600/2-79-081) Avail: NTIS HC A15/MF A01 CSCL 07D

Improved techniques for sampling and analyzing volatile organic compounds in the ambient air were developed and evaluated. Emphasis was placed on techniques for halocarbons and other compounds known or suspected of being carcinogenic. Areas of investigation included (1) the evaluation of XAD-2, charcoal and Tenax GC sorbents for in situ formation on halogenated organics during the sampling air containing chlorine and olefins; (2) the development and testing of a cryoheater module for a thermal desorptions inlet-manifold; and (3) the characterization and quantification of hazardous organic vapors in ambient air collected at several different geographical areas within the continental United States. GRA

N80-11186# Bureau of Mines, Reno, Nev. Reno Metallurgy Research Center.
PLATINUM-SUBSTITUTE MATERIALS AS ELECTROCATALYSTS FOR OXYGEN REDUCTION
W. N. Cathey, L. J. Nicks, and D. J. Bauer 1979 23 p refs
(PB-297261/0; BM-RI-8341) Avail: NTIS HC A02/MF A01 CSCL 07D

Materials including carbides, silicides, phosphides, borides, nitrides, oxides, and metals were studied as potential fuel cell catalysts for electroreduction of oxygen in a 1N H2SO4 electrolyte. An assessment of the potential of abundant, low-cost materials as substitutes for platinum and a means to increase the catalytic efficiency of platinum are discussed. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-11187# Materials Research Labs., Melbourne (Australia).
A THERMOGRAVIMETRIC SYSTEM FOR INVESTIGATING GAS-METAL REACTIONS AT ELEVATED TEMPERATURES
Lawrence D. Palmer Oct. 1978 36 p refs
(MRL-R-726; AR-001-357) Avail: NTIS HC A03/MF A01

The thermogravimetric system recently established at MRL to study the kinetics of reactions between solids and their gaseous environments at elevated temperatures is described. Changes in the weight of heated samples, due to reactions such as high-temperature oxidation of metals, are measured by a sensitive, large-capacity electrobalance. The source of uncertainties in the measurement of both weight and temperature were considered, and experimental techniques which were introduced to minimize these uncertainties are discussed. F.O.S.

N80-11188*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL PROPERTIES AND OXIDATION AND CORROSION RESISTANCE OF REDUCED-CHROMIUM 304 STAINLESS STEEL ALLOYS
Joseph R. Stephens, Charles A. Barrett, and Charles A. Gyorgak Washington Nov. 1979 22 p refs
(NASA-TP-1557; E-065) Avail: NTIS HC A02/MF A01 CSCL 11F

An experimental program was undertaken to identify effective substitutes for part of the Cr in 304 stainless steel as a method of conserving the strategic element Cr. Although special emphasis was placed on tensile properties, oxidation and corrosion resistance were also examined. Results indicate that over the temperature range of -196 C to 540 C the yield stress of experimental austenitic alloys with only 12 percent Cr compare favorably with the 18 percent Cr in 304 stainless steel. Oxidation resistance and in most cases corrosion resistance for the experimental alloys were comparable to the commercial alloy. Effective substitutes for Cr included Al, Mo, Si, Ti, and V, while Ni and Mn contents were increased to maintain an austenitic structure. R.C.T.

N80-11189*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF THERMALLY INDUCED POROSITY ON AN AS-HIP POWDER METALLURGY SUPERALLOY
R. L. Dreshfield and R. V. Miner, Jr. Washington 1979 20 p refs To be presented at Ann. Meeting of the Am. Inst. of Mining, Met. and Petol. Engr., Las Vegas, Nev., 24-28 Feb. 1980
(NASA-TM-79263; E-178) Avail: NTIS HC A02/MF A01 CSCL 11F

The impact of thermally induced porosity on the mechanical properties of an as-hot-isostatically-pressed and heat treated pressing made from low carbon Astroloy was determined. Porosity in the disk-shape pressing studied ranged from 2.6 percent at the bore to 1.4 percent at the rim. Tensile, yield strength, ductility, and rupture life of the rim of the porous pressing was only slightly inferior to the rim of sound pressings. The strength, ductility, and rupture life of the bore of the porous pressing was severely degraded compared to sound pressings. At strain ranges typical of commercial jet engine designs, the rim of the porous pressing had slightly inferior fatigue life to sound pressings. A.R.H.

N80-11190# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
INFLUENCE OF MULTIAXIAL STRESS STATES, STRESS GRADIENTS AND ELASTIC ANISOTROPY ON THE EVALUATION OF RESIDUAL STRESSES BY X-RAYS
H. Doelle Apr. 1979 52 p refs
(Contract N00014-75-C-0580)
(AD-A067909; TR-22) Avail: NTIS HC A04/MF A01 CSCL 11/6

This paper reviews treatments for these nonlinear distributions, including stress gradients, shear-stresses and anisotropic X-ray elastic constants. Methods for the evaluation of stresses are reported, and recommendations are given for the practical application of X-ray stress measurement. GRA

N80-11191# Dayton Univ. Research Inst., Ohio.
IMPACT INDUCED TENSILE FAILURES IN STEEL
Stephen J. Bless and John P. Barber Feb. 1979 55 p refs
(Contract F33615-76-C-5124; AF Proj. 2307)
(AD-A072477; UDR-TR-78-56; AFML-TR-79-4020) Avail: NTIS HC A04/MF A01 CSCL 11/6

Steel spheres 11 mm in diameter struck hemispherical and cylindrical targets at 3 km/s. Materials were AISI 1020 and 4340. Tensile strength of these materials at strain rates of .0001/s to 1000/s was determined and important rate effects were observed. Peak particle velocity as a function of range and angle was measured by a fly-off plate technique. Peak stress was calculated from these data. Failure modes were determined from post-impact analysis of targets. Targets less than 6 cm diameter were totally fragmented. The 8 cm diameter hemispheres failed in bi-axial tension. The 4 cm thick hemispheres failed by planar spall. Large targets did not undergo gross tensile failure. GRA

N80-11192# Dayton Univ. Research Inst., Ohio.
STRAIN RATE EFFECTS ON ULTIMATE STRAIN OF COPPER Technical Report, Oct. 1976 - Oct. 1977
David P. Bauer and S. J. Bless May 1979 85 p refs
(Contract F33615-76-C-5124; AF Proj. 2307)
(AD-A072175; UDR-TR-78-45; AFML-TR-79-4021) Avail: NTIS HC A05/MF A01 CSCL 11/6

The strain-rate effect on strain to failure of copper was experimentally investigated. Both Oxygen Free High Conductivity (OFHC) copper and Electrolytic Tough Pitch (ETP) copper were studied. Ultimate strains were measured for a range of strain rates from 0.0001 strain/second to over 10000.0 strain/second.

Normal quasi-static tensile machines were used at low strain rates, a split Hopkinson bar apparatus was used at strain rates of 1000.0 strain/second, and an exploding tube technique was developed for strain rates to over 10000.0 strain/second. High speed photographic techniques and post shot fragment analysis were used to determine the strain rate effects. Copper shows little strain rate dependence below 1000.0 strain/second with average ultimate strains around 0.4. Above approximately 5000.0 strain/second, several geometrical and material related factors cause the average ultimate strain to increase to values above 1.3, due to suppression of necking in the material until very late in the straining process. OFHC copper and ETP copper behave much the same to strain rates of 10000.0 strain/second. GRA

N80-11193# Naval Research Lab., Washington, D. C.
LOSS OF FRACTURE RESISTANCE IN HIGH CARBON STEEL DUE TO NON-MARTENSITIC PHASES Interim Report
R. J. Weimer, W. L. Phillips, and C. Kim 5 Jul. 1979 13 p refs
(RR0220441)
(AD-A072051; NRL-MR-4031) Avail: NTIS HC A02/MF A01 CSCL 11/6

Attempts to control the dynamic compression failure modes of tungsten fiber reinforced steel matrices included changing the matrix material from mild steel to a hypereutectoid steel. However, the thermo-mechanical processes used to fabricate such metal matrix composite materials produce mixed microstructures, and it was not known to what extent the nonmartensitic transformation products influence mechanical behavior. This work examines the effects of isothermally transformed pearlite, bainite, and cementite on the strength, ductility, and plane-strain fracture toughness of a hypereutectoid silico-manganese steel that typifies the compositions being evaluated for a class of metal matrix composite systems. The small-grained, quenched-and-tempered martensite was the toughest material (60 MPa sq. root of m). Increasing the pearlite content gradually decreased the fracture toughness. However, increasing the banite content by even slight amounts produced a catastrophic decrease in fracture toughness to half that value, which was found to be nearly the minimum KIC determined from low temperature (-54C) tests, i.e., 28 MPA sq. root of m. This result dramatizes the importance of careful heat treatment when using such materials in engineering structures. GRA

N80-11194# Pratt and Whitney Aircraft, Middletown, Conn. Materials Engineering and Research Lab.
HOT CORROSION DEGRADATION OF METALS AND ALLOY: A UNIFIED THEORY Final Scientific Report, 1 Jun. 1978 - 30 Sep. 1978
C. S. Giggins and F. S. Pettit Jun. 1979 145 p refs
(Contract F44620-76-C-0123; AF Proj. 2306)
(AD-A072645; PWA-FR-11545; AFOSR-79-0905TR) Avail: NTIS HC A07/MF A01 CSCL 11/6

The hot corrosion attack of metals and alloys has been examined over an extensive range of experimental conditions in order to develop a hot corrosion theory. Experiments have been performed at temperatures from 700 to 1000 C in air and in gases containing oxygen and SO3. Sodium sulfate was the principal deposit used to induce attack and the effects of NaCl and carbon in the Na2SO4 was also studied. Nickel- and cobalt-base alloys containing various amounts of chromium, aluminum, molybdenum and tungsten constituted the principal materials studied. The hot corrosion attack of alloys has been found to consist of an initiation stage and a propagation stage. The factors which determine the length of the initiation stage and the type of propagation mode are shown to be; alloy composition, fabrication condition, gas composition and velocity, salt composition, salt deposition rate, condition of salt, temperature, temperature cycles, erosion and specimen geometry. The hot corrosion propagation modes are described and shown to consist of fluxing processes and processes involving the oxidation of phases formed in alloys as a result of reaction with components in the deposit (e.g. sulfides, chlorides). The effects produced by a number of different elements (e.g. Cr, Al, Mo, W) on the hot corrosion of alloys is examined. It is shown that by using the unified theory for hot corrosion, previous inconsistencies are resolved. GRA

N80-11195# Naval Postgraduate School, Monterey, Calif.
CORROSION FATIGUE OF A MARINE ALUMINUM ALLOY (5456-H343) IN THE PRESENCE OF SHALLOW CRACKS M.S. Thesis
Terrence L. Tinkel Jun. 1978 147 p refs
(AD-A072562) Avail: NTIS HC A07/MF A01 CSCL 11/6

Marine aluminum alloy 5456-H343 is a candidate primary structural material for naval high performance ships. This material in the form of 1/8 inch sheet was used to obtain initial alternating surface stress v cycles to failure data in air and salt water. Room temperature tests were performed using deflection controlled fully reversed bending at 30 Hz. Data were obtained for smooth and shallow, sharply notched specimens for fatigue lives up to 10 million cycles. Notches were semi-elliptical surface cracks with depths equal to .002 in., .0115 in., and .025 in. The 5456-H343 showed excellent corrosion fatigue resistance in salt water, with increasing environmental sensitivity in the range of 1-10 million cycles. The material exhibits some notch sensitivity at a fatigue life of 10 million cycles. The following fatigue design/failure criterion were developed: (1) for shallow cracks less than .001 in. deep, the maximum fatigue stress is determined by endurance limit or fatigue strength of smooth specimens, and (2) for shallow cracks greater than .020 in. deep, the maximum fatigue stress is determined by the threshold or allowable stress intensity factor of notched specimens. GRA

N80-11196# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
EVALUATION OF YTTRIATED TITANIUM 6 Al-4 V PLATES AND FORGINGS Final Report, Jun. 1975 - Aug. 1978
A. E. Gunderson and R. F. Geisendorfer Jan. 1979 124 p refs
(AF Proj. 2418)
(AD-A072439; AFML-TR-78-158) Avail: NTIS HC A06/MF A01 CSCL 11/6

This program evaluated the effects of yttrium additions to titanium 6Al-4V alloy by means of mechanical property testing and metallurgical studies. Product forms evaluated which contained yttria (yttrium oxide) included hand forgings, die forgings, and plate material which were compared to baseline plate material which had no yttria additions. The summary of results of the mechanical property evaluations are presented below. Certain heats and specimens did appear as outliers from the norm and these have been noted. Metallographic evaluations of the yttriated material demonstrated the yttria particles are readily observable by optical and scanning electron microscopy. Fracture surface analysis on the failed fatigue and tensile specimens did not establish a direct correlation between specimen performance and yttria particles or clusters. These results indicate the effects of yttria additions are indirect and more subtle, and that the variations in data are more likely to be a consequence of the differences in mill processing procedures due to the greater hot workability of the yttriated titanium. GRA

N80-11197# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
A PHENOMENOLOGICAL MECHANISM FOR THE OCCURRENCE OF THE EXTRUSION CENTRAL BURST DEFECT Interim Technical Report, 15 Feb. 1978 - 10 Jan. 1979
F. J. Gurney Wright-Patterson AFB, Ohio AFML Apr. 1979 31 p refs
(Contract F33615-78-C-5003; AF Proj. 2418)
(AD-A072476; FM-TR-79-4031) Avail: NTIS HC A03/MF A01 CSCL 11/6

Six billets of 7075 Al were partially extruded in a horizontal extrusion press using a three-inch diameter container. Extrusion conditions were selected such that the central burst defect would occur. A rigid ram stop mechanism was employed to halt the extrusion process abruptly after selected increments of deformation were achieved in each billet. Both metallographic and scanning electron microscopy analyses were used to identify the mechanism for occurrence of the defect. The occurrence of the defect was found to be preceded by the development of tangential velocity discontinuity surface in the deformation zone. Enhanced metal flow in the radial direction on the die exit side of this discon-

tinuity surface caused tensile stresses to develop along the axis of the billet initiating the defect by a tensile overload mechanism. The defect was found to propagate along the discontinuity surface but was halted when continued ram motion caused continued plastic flow along this discontinuity surface to become diffused. GRA

N80-11198# California Univ., Berkeley.
ADSORPTION OF OXYGEN ON Pt (111) AND ITS REACTIVITY TO HYDROGEN AND CARBON MONOXIDE Interim Report
David R. Monroe and Robert P. Merrill Oct. 1978 23 p
(Grant AF-AFOSR-2926-76; AF Proj. 2303)
(AD-A072710; AFOSR-78-1432TR) Avail: NTIS HC A02/MF A01 CSCL 07/2

Oxygen was found to adsorb on Pt(111) with an initial sticking coefficient of 0.048 - or - .006 and linear adsorption kinetics. The surface saturated at an oxygen to platinum ratio of 1:4. The reactivity of adsorbed oxygen to hydrogen and CO was determined from steady state oxygen coverages for H2-O2 and CO-O2 mixtures. From the reactivity data which show reaction probabilities of 1.0 for CO and 1/2 for H2 over a wide range of oxygen coverages, it is concluded that both H2 and CO are reactive in mobile states which are probably the precursors to adsorption. GRA

N80-11199# Effects Technology, Inc., Santa Barbara, Calif.
ASSESSMENT OF THE STATE OF KNOWLEDGE PERTAINING TO SOLID PARTICLE EROSION Final Report
William F. Adler 30 Jun. 1979 153 p refs
(Contract DAAG29-77-C-0039)
(AD-A073034; ETI-CR79-680; ARO-14980.1-MS) Avail: NTIS HC A08/MF A01 CSCL 11/6

This investigation examines the analyses of solid particle erosion which have been formulated for both ductile and brittle materials. The solid particle erosion process can be described qualitatively for several materials from microscopic examinations of the eroded surfaces; however, most of the available erosion analyses are based on material removal models which do not represent the physical processes of material removal as they are presently known. A number of published results have been generally accepted by the erosion community without proper scrutiny of the basis for the conclusions reached. Some of these inconsistencies are pointed out, and the various analytical approaches used in describing solid particle erosion phenomena are summarized. The need for an adequately characterized solid particle erosion testing capability is indicated due to the range of test parameters, which have been found recently to significantly influence the measured erosion rates. Meaningful advancement in the field is strongly dependent on the development of a reliable experimental data base and experimentation which isolates and clarifies a particular feature of the material removal process. GRA

N80-11200# State Univ. of New York at Stony Brook.
THE RESPONSE OF COATED STEELS TO CAVITATION IN CORROSIVE ENVIRONMENTS
H. Herman, C. R. Clayton, M. Dorfman, S. Safai, and J. Vargas Mar. 1979 84 p refs
(Contract N00014-75-C-1016)
(AD-A072841; TR-4) Avail: NTIS HC A04/MF A01 CSCL 11/6

This ONR-supported program has concentrated on the cavitation-erosion behavior of thermal-sprayed coatings on steel in distilled and in salt water. The coatings have been Zn, Al and Zn-150 w/o Al. Porosity is a major cause of failure in a cavitation field, and further work is proposed whereby the porosity can be controlled and the coatings examined both from the points of view of corrosion (visually and electrochemically) and cavitation-erosion (visually and with weight-change measurements). The microstructures of both oxide and metal coatings have been examined through X-ray diffraction and using scanning and transmission electron microscopy techniques. Aside from active coatings, it is also desired to examine thermally-sprayed stainless steels, exothermic coatings and sprayed metallic glass forming materials. Acoustic emission (AE) is being developed as an important tool for coating evaluation. It is one goal to relate AE measurements to cavitation-corrosion survivability. GRA

N80-11201# Failure Analysis Associates, Palo Alto, Calif.
FRACTURE AND FATIGUE PROPERTIES OF 1Cr-Mo-V BAINITIC TURBINE ROTOR STEELS
I. Roman, C. A. Rau, Jr., A. S. Tetelman, and K. Ono Mar. 1979 268 p refs
(EPRI Proj. 700-1)
(EPRI-NP-1023) Avail: NTIS HC A12/MF A01

The deformation, fracture and fatigue properties of 1Cr-Mo-V turbine rotor steel have been evaluated for a wide range of loading conditions and metallurgical structures controlled by melting and heat treatment practice. The mechanical property differences and corresponding metallurgical differences between older, air-melted steels and newer heats that are vacuum degassed were determined. The effects of prior fatique cycling on fracture toughness were measured, and a model was developed to predict the effect for various materials and loading conditions. Irrespective of the fracture mode, materials which soften under strain cycling, like this rotor steel, show a toughness which increases with number and magnitude of prior fatigue cycling. DOE

N80-11202# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
INVESTIGATIONS OF INTERMETALLIC ALLOY HYDRIDING MECHANISM Annual Progress Report, 1 May 1978 - 30 Apr. 1979
B. R. Livesay and J. W. Larsen Apr. 1979 169 p refs
(Contract EY-76-S-05-5246)
(ORO-5246-3) Avail: NTIS HC A08/MF A01

Investigations are reported on mechanisms involved with hydrogen metal interactions which control the absorption and desorption processes in intermetallic compounds. A microbalance to determine the thermodynamic parameters is presented. DOE

N80-11203# Iowa State Univ. of Science and Technology, Ames. Dept. of Materials Science and Engineering.
LOW TEMPERATURE HEAT CAPACITY STUDIES ON HYDROGEN ABSORBING INTERMETALLIC COMPOUNDS
T. Takeshita, G. Dublon, O. D. McMasters, and K. A. Gschneidner, Jr. 1979 5 p refs Presented at Rare Earth Res. Conf., Fargo, N.D., 25 Jun. 1979
(Contract W-7405-eng-82)
(IS-M-210; Conf-790641-4) Avail: NTIS HC A02/MF A01

Low temperature heat capacities of some ternary Hauke compounds were studied. The electronic specific heat constants of these compounds decrease as Ni is substituted with Al or Cu. The Debye temperatures show some variations but not in a systematic manner for the aluminum substitution. In the aluminum substituted ternaries, there is no correlation between the hydrogen absorption capacity with the electronic specific constant and the Debye temperature except for ThNi2Al3. In the pseudo-binary system, LaNi5 - /sub x/Cu/sub x/, the stability of the metal hydride may be rigidity of the metal lattice, i.e., softer the metal lattice the more related to the stable the metal hydride. This is in agreement with our previous observations. DOE

N80-11204# Sandia Labs., Albuquerque, N. Mex.
IMPLANTED AND ANNEALED ALLOYS IN PHYSICAL METALLURGY
S. M. Myers 1978 27 p refs Presented at the Conf. on Ion Beam Modification of Materials, Budapest, 4 Sep. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1638C; Conf-780932-5) Avail: NTIS HC A03/MF A01

The annealing behavior of implanted metals is presented. All metal systems are considered. In such systems, defect related phenomena are generally less dominant than in semiconductors or insulators. DOE

N80-11205# Los Alamos Scientific Lab., N. Mex.
CONTOUR FORMING OF VARIOUS METALS: DEFORMATION AND RECRYSTALLIZATION CHARACTERISTICS
James F. Muller 1978 12 p Presented at SAMPE Conf., Kiamesha Lake, N.Y. 17 Oct. 1978
(Contract W-7405-eng-36)
(LA-UR-78-1412; Conf-781068-2) Avail: NTIS HC A02/MF A01

The effects of different forming and annealing sequences on resultant grain size were investigated for several materials. Deep

drawing as well as forging techniques were employed. One evaluation was additionally performed to determine the contribution of size effects. DOE

N80-11208# Los Alamos Scientific Lab., N. Mex.
EFFECT OF PERIODIC CHEMICAL VARIATION ON THE MECHANICAL PROPERTIES OF Ta FOILS
R. W. Springer, N. L. Ott (St. Joseph's College, Philadelphia), and D. S. Catlett 1978 11 p refs Presented at 25th Natl. Am. Vacuum Soc. Symp., San Francisco, 27 Nov. - 1 Dec. 1978
(Contract W-7405-eng-36)
(LA-UR-78-3065; Conf-781130-5) Avail: NTIS HC A02/MF A01

Acetylene gas was admitted to the chamber over approximately two orders of magnitude of pressure during Ta deposition. Residual gas analysis was used to verify that a reaction between the Ta film and the gas occurred. Subsequent Auger analysis showed that the carbon in the films could be predicted using simple pressure vs rate equation. The pulse gas process (PGP) has been applied to the electron beam gun deposition of Ta. Tensile test specimens a few micro-meters thick have been produced to show fracture strengths varying from approximately 170 MPa to approximately 860 MPa for pure to highly pulsed runs. The fracture strength loosely follows a Hall-Petch relation fracture strength to the time between pulses. Although diffusion of the carbon smoothes out the chemical period, it is thought that the remaining structure accounts for the strength enhancement. DOE

N80-11207# Bendix Corp., Kansas City, Mo.
PULSE PLATING OF HARD GOLD ELECTRODEPOSITS
C. J. Stimetz and J. J. Hren Feb. 1979 16 p refs Presented at Intern. Symp. on Pulse Plating, Boston, Mass., 19 Apr. 1979
(Contract EX-76-C-04-0613)
(BDX-613-2165; Conf-790450-1) Avail: NTIS HC A02/MF A01

The conventional and pulse plated, cobalt hardened gold deposits were evaluated and differences in cobalt chemical composition, morphology, and microstructure were determined. Cobalt hardened gold samples were plated on polished brass substrates for morphology study. For microstructure and chemical composition the substrate was stainless steel-304. DOE

N80-11208# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
ACOUSTIC EMISSION FROM HYDROGEN SATURATED TYPE 304L STAINLESS STEEL
G. R. Caskey, Jr. 1978 16 p refs Presented at TMS/AIME Fall Meeting, St. Louis, Mo., 15 Oct. 1978
(Contract EY-76-C-09-0001)
(DP-MS-78-50; Conf-781093-1) Avail: NTIS HC A02/MF A01

Acoustic emission was monitored during tensile tests of Type 304L austenitic stainless steel to explore the applicability of the technique to hydrogen-assisted fracture. DOE

N80-11209# Oak Ridge National Lab., Tenn.
DUCTILITY MINIMUM AND ITS REVERSAL WITH PROLONGED AGING IN COBALT-AND NICKEL-BASE SUPERALLOYS
1978 15 p refs Presented at ASME Meeting, San Francisco, Calif., 10 Dec. 1978
(Contract W-7405-eng-26)
(CONF-781202-35) Avail: NTIS HC A02/MF A01

The cobalt-base superalloys Haynes alloy No. 25 and Haynes alloy No. 188 and the nickel-base superalloy Inconel 625 show a pronounced ductility minimum at temperatures of 760 and 704 C, respectively, in the solution-annealed condition. However, after prolonged (11,000 h) aging at 816 C (1500 F), copious precipitates form to completely reverse the behavior. These precipitates reduce tensile ductility drastically up to temperatures where the ductility dip is observed for the solution-annealed condition; then the brittle behavior from aging gives way to greatly enhanced ductility. This behavior in Haynes alloy No. 25 is examined in detail. Its tensile properties in the solution-annealed and 816 C-aged conditions are correlated with mode of fracture and the amounts, identity, and morphology of the precipitates. The latter were assessed by optical and scanning electron metallography, microhardness, electron microprobe, and X-ray diffraction. The minimum and its reversal are explained by thermally activated processes, which began with the onset of recovery. DOE

N80-11210# Illinois Univ. at Urbana-Champaign, Urbana. Graduate Coll.
STUDY OF METAL-OXYGEN SOLID SOLUTIONS UTILIZING SOLID ELECTROLYTIC CELLS Ph.D. Thesis
Robert John Lauf Oct. 1978 104 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1216) Avail: NTIS HC A06/MF A01

A study was made of the thermodynamic and kinetic behavior of oxygen in a number of Group V metals and alloys. Investigations were made with a ThO2/Y2O3 electrolyte over the temperature range of 600 to 1150 C (873 to 1423 K). The activity of oxygen in three Nb-Ta alloys (nominally 25, 50, and 75 at. % Ta) was found to obey Henry's Law up to the solubility limit in each alloy. The standard entropy and enthalpy of solution of oxygen in the three Nb-Ta alloys were intermediate between those for pure niobium and pure tantalum, and varied almost linearly with Nb : Ta content. The diffusion coefficient of oxygen was measured in niobium and vanadium, and the values were found to be in excellent agreement with literature values obtained by a variety of techniques. The diffusion coefficient of oxygen in each of several dilute substitutional niobium alloys was measured and compared to the diffusion coefficient in pure niobium. The addition of 1 to 5% substitutional solutes resulted in as much as an order-of-magnitude decrease in the oxygen diffusivity.DOE

N80-11211# Argonne National Lab., Ill.
HIGH PRECISION METAL STABLE ISOTOPE RATIO MEASUREMENTS USING VOLATILE METAL CHELATES
D. L. Hachey, J. Johnston, and P. D. Klein 1978 15 p refs Presented at 3d Intern. Conf. on Stable Isotopes, Oak Brook, Ill., 23 May 1978
(Contract W-31-109-eng-38)
(CONF-780501-7) Avail: NTIS HC A02/MF A01

A series of volable metal chelates were prepared for magnesium, calcium, iron, and cadmium. Extraction efficiency studies were done for magnesium and calcium in order to define the optimum conditions of pH and chelating agent required for recovery of these elements from aqueous media. Mass spectra of these chelates were obtained to evaluate their suitability for the measurement of metal stable isotope ratios. Chemical ionization mass spectrometry is most useful for the measurement of transition metal isotope ratios but electron ionization mass spectrometry is required for measurement of calcium and magnesium isotope ratios, since these elements are extensively polymerized in the gas phase. Isotope ratios can be measured to an absolute accuracy of +-0.03 to 0.72 percent, depending on the element, the ionization technique and the magnitude of the isotope ratio. The natural abundance can be determined in a single run for as many as eight isotopes or one element with better than +-0.48 percent accuracy when corrected for the natural abundance of C(13), H(2), and O(18) present in the chelating agent. DOE

N80-11212# Oak Ridge National Lab., Tenn.
TENSILE AND CREEP PROPERTIES OF TYPE 316 STAINLESS STEEL
V. K. Sikka 1978 31 p Presented at the UK/UKAEA Specialists Meeting on Mechanical Properties, Oak Ridge, Tenn., 4 Dec. 1978
(Contract W-7405-eng-26)
(CONF-781219-3) Avail: NTIS HC A03/MF A01

A mechanical property characterization test program on type 316 stainless steel is presented. Information for the formulation and verification of constitutive equations, setting failure criteria, and verification of design stresses and rules is discussed. DOE

N80-11213# Oak Ridge National Lab., Tenn.
MECHANICAL PROPERTIES OF MODIFIED 9 Cr-1 Mo STEEL
V. K. Sikka 1978 15 p Presented at the UK/UKAEA Specialists Meeting on Mechanical Properties, Oak Ridge, Tenn., 4 Dec. 1978

(Contract W-7405-eng-26)
(CONF-781219-2) Avail: NTIS HC A02/MF A01

A mechanical property evaluation of 24 experimental and 1 large commercial heat Mo steel developed by Combustion Engineering is presented. The mechanical properties evaluation involves the following tests: Charpy impact test to determine the ductile brittle transition temperature, tensile tests at room temperature and 649 C, and screening creep and creep rupture tests at 593 and 649 C. DOE

N80-11214*# Sandia Labs., Albuquerque, N. Mex.
EFFECTS OF IMPURITIES ON THE WELDABILITY OF ELECTROFORMED NICKEL
J. A. Brooks, J. W. Dini, and H. R. Johnson Dec. 1978 38 p refs
(NASA Order-L-50230A; Contract EY-76-C-04-0789)
(NASA-CR-162455; SAND-78-8774) Avail: NTIS HC A03/MF A01 CSCL 11F

The effect of impurities on weld cracking of electroformed nickel was studied using gas tungsten arc welding, varestraint testing and hot ductility testing. High purity electroformed nickel was found to be very resistant to weld cracking; furthermore, intentional additions of copper and iron to levels above those commonly observed in electrodeposits had no detrimental effects on welding. However, nickel electrodeposits with sulfur and lead impurities were found to exhibit increased susceptibility to weld cracking with increasing impurity content. High levels of carbon, oxygen, and nitrogen result in intergranular porosity of the weld heat affected zone and this leads to weld cracking resulting from locally reduced strength and ductility. Other cracking mechanisms resulting from impurities are proposed. DOE

N80-11215# Ames Lab., Iowa.
ANNEALING OF NEUTRON-IRRADIATED VANADIUM CONTAINING OXYGEN M.S. Thesis
R. E. Foster Jan. 1979 54 p refs
(Contract W-7405-eng-82)
(IS-T-816) Avail: NTIS HC A04/MF A01

The role of interstitial oxygen in irradiated vanadium was studied by measuring the activation energy of the 0.2 T/sub m/ recovery stage in well-characterized samples, where T/sub m/ is the melting temperature in degrees Kelvin. DOE

N80-11216# Ames Lab., Iowa.
STRUCTURAL STUDY OF HIGH TEMPERATURE METAL-RICH TITANIUM SULFIDE PHASES Ph.D. Thesis
J. P. Owens Jan. 1979 206 p refs
(Contract W-7405-eng-82)
(IS-T-832) Avail: NTIS HC A10/MF A01

Ti2S and Ti8S3 were prepared by high temperature annealing techniques. The crystal structures of these two phases were determined from single crystal X-ray diffraction data. Both structures were refined using a full-matrix least-squares treatment of positional parameters and isotropic temperature factor coefficients. Ti2S crystallizes with orthorhombic symmetry, space group Pnnm, having unit cell dimensions a = 11.367A, b = 14.060A, and c = 3.326A. Ti2S is isostructural with Ta2P. Ti8S3 crystallizes with monoclinic symmetry, space group C2/m,a = 32.69A, b = 3.327A, c = 19.35A, Beta = 139.9 deg (b - unique). Ti2S and Ti8S3 have structural features similar to the features of a large number of metal-rich transition-metal chalcogenides and pnictides. These various structure types have been characterized in terms of nonmetal trigonal prismatic coordination polyhedra, eight different metal partial coordination polyhedra, a short (approximately equal to 3.4A) crystallographic axis, two unique layers of atoms containing both metal and nonmetal atom positions, and mirror planes coincident with the two layers of atom positions. DOE

N80-11217# Illinois Univ., Urbana. Dept. of Physics.
CATALYSIS BY TRANSITION METAL COMPOUNDS Ph.D. Thesis
David Lee Klein 1978 153 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1234) Avail: NTIS HC A08/MF A01

The catalytic properties of cobalt oxide were investigated theoretically. The interactions of atomic hydrogen with small clusters of atoms, representing cobalt oxide surfaces, were calculated using the ab initio Unrestricted Hartree-Fock method. The electronic structure of the bulk solid was studied through band and cluster models. The bulk electronic structure computed predicts insulating behavior for cobalt oxide and agrees with experimental optical results. The perfect (100) cobalt oxide surface was determined not to chemisorb atomic hydrogen. Singly-ionized oxygen ions located near cation vacancies were found to chemisorb hydrogen, forming two-center covalent bonds. The effect of lattice defects on the creation of singly ionized oxygen ions was examined. A systematic procedure for the study of surface and bulk electronic properties is discussed. DOE

N80-11218# Defence Research Information Centre, Orpington (England).
THE DEPOSITION OF GOLD - COPPER - CADMIUM ALLOYS
M. Dettke London Dec. 1978 6 p Transl. into ENGLISH from Oberflaeche-Surface, v. 18, no. 4, 1977 p 101-102
(DRIC-Trans-5465; BR67498) Avail: NTIS HC A02/MF A01

Methods of electrolytic deposition of low carat gold alloys using gold - copper - cadmium systems are described. The production and properties of hard gold coatings, current densities for regulating the color in decorative electroplating, corrosion resistance of the coatings, and the possibility of sandwich plating are considered. An isotope irradiator whose electrons penetrate about five microns is suggested as suitable for producing coatings eight microns thick while for thinner coatings a carbon 14 irradiator is recommended. Author (ESA)

N80-11219# Royal Aircraft Establishment, Farnborough (England).
A CREEP DATA LIBRARY FOR DTD 5070A ALUMINUM ALLOYS
J. N. Webb London Dec. 1978 17 p refs Document includes a microfiche supplement. This supplement is available in microfiche on request from the NASA Scientific and Technical Information Facility
(RAE-TR-78067) Avail: NTIS HC A02/MF A01

Tensile creep and strain recovery data, accumulated during an investigation into creep behavior under varying load conditions of an aluminum alloy suited to airframe applications at elevated temperature, are presented. The data is of high quality as special attention was paid to the control of temperature, load, and load axiality. Data are included from continuous creep tests over a range of stresses (80 to 250 MM/sqm) and temperatures (150 to 195 C) as well as from tests, mainly at 180 C, involving prior heating and step changes in load level. Particular attention was paid to transient response and the effect of strain recovery periods. Each test phase was accurately fitted with a polynomial; computer printouts were obtained listing time, measured and fitted strain, strain rate, and the second derivative together with the polynomial coefficients. These collected printouts comprise the library of creep data which are presented in microfiche form. Author (ESA)

N80-11220# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
THE INFLUENCE ON THE FATIGUE PROPERTIES OF ALUMINUM AZ 74 FROM PROCESS VARIANTS IN SULPHURIC ACID ANODIZING
Nils Larsson 1979 37 p ref
(Contract FMV-F-FL-82223-76-001-21-001)
(FFA-TN-HU-1943) Avail: NTIS HC A03/MF A01

A fatigue investigation of surface treated aluminum AZ 74 (3633-4) is reviewed. The test specimens were turned and notched (K = 1.5). The loading was axial tension with R = 0. The separate processes used in treatment and some ten process variants are detailed. Owing to a limited number of test specimens, the investigation only admits rough estimations. However, process variants supposed to be detrimental, but not appearing so, as well as variants associated with considerable improvements point to the necessity of attention to details in anodizing processes. Author (ESA)

N80-11221# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
FATIGUE TESTING OF PRECIPITATING STEEL 1745

(CUSTOM 455) WITH MACHINING AS THE FINAL PROCESS

Nils Larsson 1979 35 p
(Contract FMV-F-K-82223-76-001-21-001)
(FFA-TN-HU-1965) Avail: NTIS HC A03/MF A01

Results from fatigue testing of turned specimens of a precipitation hardened steel are presented. The specimens were either plain or notched (K = 2.5 and K = 4.0) with machining as the final process. The fatigue testing was carried out with R = -1, R = 0, and sigma min = 300 N/sq mm. Supplementary static tests were performed. The ultimate tensile strength for plain specimens was 1612 N/sq mm. The fatigue results are presented as S-N curves and are also revised to Haig diagrams. *Notch fatigue factors (Kf) were calculated and are shown.*

Author (ESA)

N80-11222# *Metallkundelabor an der Fachhochschule, Kiel (West Germany).*

ANALYSIS OF THE INFLUENCE OF SPACE CONDITIONS UPON REACTIONS BETWEEN LIQUID AS WELL AS GASEOUS CORROSIVE AGENTS AND METALS Final Report

Guenther Mix Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 150 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-SLN-7751; DFVLR-BPT-01-QV-205-B22)
(BMFT-FB-W-77-10) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 31,30

In order to eliminate the deleterious influence of convection on research into chemical reactions between aquatic electrotypes and metallic surfaces, a low gravity environment is necessary. A comprehensive evaluation of the literature describing liquid mechanics under low gravity conditions is given in support of the use of SPACELAB for this type of study. Advantages cited include a gravitational field of 1/10,000 g, a low temperature gradient, and a low concentration gradient. It is shown that *material transport depends on diffusion only under these* conditions. Six experiments are proposed; i.e. the measuring of the double-layer capacity and the adsorption on metallic *surfaces, corrosion of homogeneous metals, pitting corrosion, and* cathodic protection against corrosion. Author (ESA)

N80-11223# Uppsala Univ. (Sweden). Inst. of Technology.

ON THE INFLUENCE OF NICKLE ON TOUGHNESS AND DUCTILE-BRITTLE TRANSITION IN LOW-CARBON LATH MARTENSITE STEELS

Lars-Aake Norstroem (Uddeholms AB) Jun. 1978 36 p refs
(UPTEC-78-53-R) Avail: NTIS HC A03/MF A01

The ductile-cleavage transition was studied with respect to grain size, yield strength, and nickel content by impact testing *of low-carbon (< 0.1 percent C) lath martensite steels with 5%* Mn, 5% Ni, and 9% Ni. The impact transition temperature (ITT) is found to be controlled by the martensite packet size and the yield strength. Regardless of packet size and yield strength, nickel additions imply powerful intrinsic toughness improvments while decreasing the ITT by as much as 20 C per percent nickel. At the same time, nickel moderated the effect of packet size and yield strength on ITT. These important effects of nickel additions *are mainly attributed to a corresponding increase in cleavage* fracture resistance and form the basis for the use of Ni-steels in cryogenic applications. Author (ESA)

N80-11224# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

FATIGUE TESTING OF FORGED TITANIUM

Nils Larsson Feb. 1979 31 p
(Contract FMV-F-FL-82223-77-001-21-001)
(FFA-HU-1997) Avail: NTIS HC A03/MF A01

Results from fatigue testing with specimens of forged titanium *AMS 4971 satisfying the Saab-Scania specifications 6466-2 and* 6466-3 are presented. The specimens were taken longitudinally as well as transversely from six similar forgings. They were turned *and either plain (k sub t = 1.0) or notched (k sub t = 2.5 and* 4.0). The fatigue testing was carried out with r = -1, R = 0, and sigma min = 250 N/sq mm. Supplementary static tests were performed. The ultimate tensile strength for plain specimens was 1020 and 1230 N/sq mm for 6466-2 and 6966-3, respectively. Most of the fatigue testing was devoted to 6466-2 returning seven S-N curves. Comparisons between the two conditions (6466-2, 6466-3) and the two forging directions (longitudinal, transverse) were made in the case k sub t = 2.5/R = 0. *No marked differences were noticed. Large scatter was* noticed for 6466-2 in the case k sub t = 1.0/R = 0.

Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-11225*# Rensselaer Polytechnic Inst., Troy, N. Y.

DETERMINATION OF PHYSICAL AND CHEMICAL STATES OF LUBRICANTS IN CONCENTRATED CONTACTS, PART 1 Final Report

James L Lauer Washington NASA Nov. 1979 58 p refs
(Grant NsG-3170)
(NASA-CR-3204) Avail: NTIS HC A04/MF A01 CSCL 11H

A Fourier emission infrared microspectrometer, set up on a vibration-proof optical table and interfaced to a dedicated minicomputer, was used to record infrared emission spectra from *elastohydrodynamic bearing contacts. Its range was extended to* cover the entire mid-infrared from 2 to 15 micron. A series of *experiments with 5P4E polyphenyl ether showed the existence* of a temperature gradient through the lubricant in an ehd contact, which is perpendicular to the flow direction. The experiments *also show marked polarization of some of the spectral bands,* indicating a molecular alignment. Alignment is less evident at high pressure than at low pressure. To account for this behavior, *a model is suggested along the lines developed for the confor-*mational changes observed in long-chain polymers when subjected to increased pressure--to accommodate closer packing, molecules *become kinked and curl up. Experiments with a traction fluid* showed periodic changes of flow pattern associated with certain spectral changes. These observations will be studied further. A *study by infrared attenuated total reflection spectrophotometry* was undertaken to determine whether gamma irradiation would change polyethylene wear specimens. The results were negative. A.R.H.

N80-11226*# *National Aeronautics and Space Administration.* Langley Research Center, Hampton, Va.

ELECTRON AND PROTON ABSORPTION CALCULATIONS *FOR A GRAPHITE/EPOXY COMPOSITE MODEL*

Edward R. Long, Jr. Nov. 1979 33 p refs
(NASA-TP-1568; L-13073) Avail: NTIS HC A02/MF A01 CSCL 11G

The Bethe-Bloch stopping power relations for inelastic collisions were used to determine the absorption of electron and proton energy in cured neat epoxy resin and the absorption of electron energy in a graphite/epoxy composite. Absorption of *electron energy due to bremsstrahlung was determined.* Electron energies from 0.2 to 4.0 MeV and proton energies from 0.3 to 1.75 MeV were used. Monoenergetic electron energy absorption *profiles for models of pure graphite, cured neat epoxy resin,* and graphite/epoxy composites are reported. A relation is determined for depth of uniform energy absorption in a composite *as a function of fiber volume fraction and initial electron energy.* Monoenergetic proton energy absorption profiles are reported for the neat resin model. A relation for total proton penetration *in the epoxy resin as a function of initial proton energy is* determined. Electron energy absorption in the composite due to *bremsstrahlung is reported.* Electron and proton energy absorption profiles in cured neat epoxy resin are reported for environments approximating geosynchronous earth orbit. R.C.T.

N80-11227# New York Univ., N. Y. Dept. of Applied Science.

***EXPLORATORY RESEARCH ON NOVEL AMBIENT TEMPER-*ATURE CURING TECHNIQUES FOR ADHESIVES, SEALANTS AND LAMINATES Final Report, 28 Feb. 1978 - 27 Feb. 1979**

Walter Brenner Apr. 1979 82 p
(Contract N00019-78-C-0169)
(AD-A072591; NYU/DAS-79/07) Avail: NTIS

HC A05/MF A01 CSCL 11/1

The performance properties of thermosetting polymer systems which are cured with the application of heat and pressure generally surpass those obtained with ambient temperature cures for the same systems. This report describes a program of research and development comprising the exploration and study of selected novel ambient temperature curing techniques with the goal of obtaining performance characteristics equaling or surpassing those achieved with conventional heat/pressure type cures. The specific room temperature curing methods experimentally investigated included electron beam radiation; flash polymerization; interfacial polymerization and anaerobic cures. Some experiments were also carried out on room temperature curing epoxy polymer systems with high temperature service capabilities. GRA

N80-11229# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.

TOXICITY AND THERMAL PROPERTIES OF POLYPHOSPHAZENES Interim Report

P. J. Lieu, J. H. Magill, and Y. C. Alarie 19 Jul. 1979 37 p refs

(Contract N00014-77-C-0310)

(AD-A072120; SETEC-MME-79-40; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/3

Flammability and toxicity of various polyphosphazenes with and without fillers have been measured. The performance characteristics of these polymers are compared with other more conventional plastics of commercial interest. Other small scale tests such as limiting oxygen index, at different heat fluxes, have been used as indicators of flammability. Under ambient conditions, polyphosphazenes require a higher oxygen concentration to burn than air alone can supply. LOI values always decrease as heat flux or ambient temperature is raised. Fillers also influence LOI measurements. Foam samples burn more readily than films of the same chemical constitution. RD(50) and LC(50) values were obtained by exposing animals (mice) to a gaseous stream of polyphosphazene decomposition products. The respiratory response of mice is directly correlatable with the rate of polymer decomposition. The toxicity of a particular polyphosphazene depends strongly upon the type of the side groups on the phosphorus. There is no direct correlation between toxicity hazard and CO concentration in these polymers. Halogen side groups give rise to the most toxic products. Based upon an overall hazard rating involving thermal stability, flammability and toxicity parameters, halogen free polyphosphazenes are favored over halogen containing polymers for high temperature applications. GRA

N80-11229# Sandia Labs., Albuquerque, N. Mex.

EFFECT OF CHEMICAL ENVIRONMENTS ON THE FRACTURE OF CERAMIC SURFACES

Robert E. Cuthrell 1978 18 p refs Presented at Symp. on Ceram. Machining and Surface Finishing, Washington, D.C., 13 Nov. 1978

(Contract EY-76-C-04-0789)

(SAND-78-1664C; Conf-781143-1) Avail: NTIS HC A02/MF A01

Environmental effects on the deformation and fracture of a variety of materials during drilling/grinding and four point bending to failure were traced to embrittlement by hydrogen. The extent of embrittlement is determined by the availability of hydrogen in the drilling fluid or in the gaseous environment in an ultrahigh vacuum chamber. The hydrogen availability is in turn dependent on its binding in liquids (ionic, covalent, ion paired in media of low dielectric constant) or by the blocking effect of adsorbed carbon monoxide in the vacuum chamber. These hydrogen effects are shown in drilling rates, maximum strain to fracture, acoustic emission amplitude (energy) distributions accompanying fracture, and scanning electron microscope photomicrographs of the fracture surfaces. DOE

N80-11230# Sandia Labs., Albuquerque, N. Mex.

COMPARISON OF POLYMER FLAMMABILITIES AND A DETERMINATION OF THE LOSS OF FIRE RETARDANT ADDITIVES WITH AGING

R. L. Clough and E. A. Salazar 1979 9 p refs Presented at JOWOG-28, Albuquerque, N. Mex., 11 Jun. 1979

(Contract DE-AC04-76DP-00789)

(SAND-79-0978C; Conf-790632-2) Avail: NTIS HC A02/MF A01

An investigation on the flammability of two major types of commercial cable insulation formulations that are widely used in nuclear applications is described. The effects of thermal and radiation aging on the combustion properties of these polymeric materials are studied including an evaluation of the potential loss of fire retardant additives. The two polymer types being studied are chlorosulfonated polyethylene (Hypalon) and ethylenepropylene rubber (EPR). The fire retardant system used commercially with both of these polymers consists of two components antimony trioxide and a chlorinated hydrocarbon. DOE

N80-11231# Carnegie-Mellon Univ., Pittsburgh, Pa.

FURTHER MEASUREMENTS OF THE SPECIFIC HEATS AT LOW TEMPERATURES IN METALLIC GLASSES Final Report

T. B. Massalski 27 Sep. 1978 8 p refs

(UCRL-13908) Avail: NTIS HC A02/MF A01

The effect of the crystallization on the electronic structure and on certain lattice properties of amorphous alloys, Pd-Si and Pd-Si-Cu is presented. The temperature dependence of the low temperature specific heats for nonmagnetic amorphous alloys was established. The customary fitting equation C = gamma T + alpha T cubed + delta T to the 5th power was found to describe adequately the data for all amorphous samples studied. The linearly temperature dependent term gamma T, which measures the density of states at the Fermi level after the correction for the electron-phonon interaction and the noncrystalline effect, was found to be strongly dependent on composition. A large, broad maximum was observed at about 19 at. percent Si in the binary system. The interaction of the conduction electrons with the first peak of the structure factor S(q) was studied. DOE

N80-11232# Bendix Corp., Kansas City, Mo.

CHARACTERIZATION OF LOW DENSITY RIGID URETHANE FOAM

F. N. Larsen Oct. 1978 20 p refs

(Contract EY-76-C-04-0613)

(BDX-513-1890-Rev) Avail: NTIS HC A02/MF A01

The chemical and mechanical properties of a low density, rigid polyurethane foam material taken from a Joint Test Assembly after 13 years of storage were measured. The chemical composition was Bendix Rigifoam 6003-1.5, a pentaerythritol/epsilon-caprolactone/tolyene diisocyanate polyurethane foam. Comparison of data from testing the thermal and mechanical characteristics with data from a currently manufactured foam of identical composition indicates no degradation of properties had occurred. This information gives added confidence to the stockpile lifetime integrity of the Rigifoam 6003-2 foam system designated for use in other programs. DOE

N80-11233# Bendix Corp., Kansas City, Mo.

SHELF LIFE DETERMINATION OF EPOXY PREPREGS AND FILM ADHESIVES Final Report

B. G. Parker Jan. 1979 24 p refs

(Contract EY-76-C-04-0613)

(BDX-613-2033-Rev) Avail: NTIS HC A02/MF A01

Kinetic data describing the cure of a Kevlar/epoxy prepreg and an epoxy film adhesive were determined by the use of Differential Scanning Calorimetry. For the Kevlar/epoxy prepreg, a correlation was found between the heat of reaction and percent resin flow; a similar correlation was found between the heat of reaction and lapshear strength for the film adhesive. An equation was derived for the determination of the B stage time required to yield an epoxy prepreg possessing the desired flow properties. The effects of storage temperature on the shelf-life of both the prepreg and film adhesive were determined. DOE

N80-11234# Ames Lab., Iowa.

THERMAL EXPANSION OF GLASSES AT LOW TEMPERATURES Ph.D. Thesis - Iowa State Univ.

K. G. Lyon Jan. 1979 89 p refs

(Contract W-7405-eng-82)

(IS-T-829) Avail: NTIS HC A05/MF A01

The linear thermal expansion coefficient was measured at temperatures to 1.2 K for two amorphous solids, fused silica

and plexiglas, using a parallel plate capacitor differential dilatometer. The low temperature expansion coefficients for these solids have the same temperature dependences as the specific heats, and show a contribution which is linear in the temperature and which can be associated with the postulate of a broad distribution of two level states. The Grueneisen parameters which are associated with this contribution are comparable for the two solids, and suggest a further indication of common behavior for amorphous solids at low temperature. Large magnitudes for Grueneisen parameters generally are associated with tunneling models. A symmetric double harmonic oscillator tunneling model can be used to understand the sign and magnitude of gamma for these solids. This model is inconsistent with other thermal and thermodynamic data for fused silica. DOE

N80-11235# Sandia Labs., Albuquerque, N. Mex.
ETCHING STUDY FOR THE MC2980 GLASS CERAMIC PREFORM
S. T. Reed and C. R. Abrams Nov. 1978 23 p refs
(Contract EX-76-C-04-0789)
(SAND-78-1295) Avail: NTIS HC A02/MF A01

Variables of the etching process for the MC2980 glass ceramic preform were studied to determine their effect upon the etching rate. These variables include: type of agitation on the preform, temperature of the etchant, duration of etch, surface finish of preform, depletion of etchant, evaporation of etchant, and interruption of etching cycle. The etching rate varied from 0.18 g/min at room temperature to 1.31 g/minute at 90 C. A constant etching rate, at elevated temperatures using the same batch of etchant, could not be maintained because of evaporation losses and the depletion of the etchant. The vapor-honed surface layer of the preform was removed after 10 min of etching at room temperature and only 2 min of etching at 80 C. DOE

N80-11236# Nevada Univ., Reno. Dept. of Chemistry.
MEASUREMENT OF DIFFUSION COEFFICIENTS OF SHORT-LIVED SPECIES IN SOLUTION AND IN AMORPHOUS GLASSES Final Report, 1 May 1967 - 31 Aug. 1978
R. D. Burkhart Aug. 1978 36 p refs
(Contract EY-76-S-08-0535)
(NVO-0535-7) Avail: NTIS HC A03/MF A01

The diffusion coefficients of 1-propyl, 1-pentyl, 1-dodecyl, 1-octadecyl cyclohexyl and benzyl radicals were measured in hydrocarbon solvents at room temperature using the method of photochemical space intermittency. The results indicate that strong radical-solvent interactions exist for all but the benzyl radical. Solvent effects observed are those to be expected from changes in viscosity. Measurements of triplet energy transfer between molecules in polystyrene matrices show that the energy transfer probability is a decreasing exponential function of the average separation distance of solute molecules. Triplet energy migration was studied in solid films of poly(N-vinyl carbazole) (PVCA). Effects of temperature on intensities and lifetimes of PVCA phosphorescence and delayed fluorescence were determined and a PVCA delayed luminescence spectrum at room temperature was obtained. DOE

N80-11237# Central Electricity Generating Board, Bristol (England). Scientific Services Dept.
GLASS FIBRE REINFORCED, SPRAYED COATING FOR SEALING THERMAL INSULATION CONTAINING ASBESTOS
P. H. Crum, inventor, B. Godfrey, inventor, R. D. Hunt, inventor, and T. K. Marston, inventor May 1979 4 p
(TDB-325) Avail: NTIS HC A02/MF A01

A method of sealing asbestos insulation was developed. It consists of simultaneously spraying short glass fiber rovings and certain water based paints of the type commonly used for sealing asbestos such that the two components mix and form, when dry, a tough membrane reinforced with randomly orientated fiber. Spraying tests were run at two electric power stations. Results show that the sprayed coatings are superior to other coatings as they extend more before perforation and are much more resistant to tearing and impact damage. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.*

N80-11238*# Union Carbide Corp., Tonawanda, N.Y. Linde Div.
ECONOMICS OF HYDROGEN PRODUCTION AND LIQUEFACTION UPDATED TO 1980
C. R. Baker Nov. 1979 41 p refs
(Contract NAS1-14698)
(NASA-CR-159163) Avail: NTIS HC A03/MF A01 CSCL 21D

Revised costs for generating and liquefying hydrogen in mid-1980 are presented. Plant investments were treated as straight-forward escalations resulting from inflation. Operating costs, however, were derived in terms of the unit cost of coal, fuel gas and electrical energy to permit the determination of the influence of these parameters on the cost of liquid hydrogen. Inflationary influence was recognized by requiring a 15% discounted rate of return on investment for Discounted Cash Flow financing analysis, up from 12% previously. Utility financing was revised to require an 11% interest rate on debt. The scope of operation of the hydrogen plant was revised from previous studies to include only the hydrogen generation and liquefaction facilities. On-site fuel gas and power generation, originally a part of the plant complex, was eliminated. Fuel gas and power are now treated as purchased utilities. Costs for on-site generation of fuel gas however, are included. A.R.H.

N80-11239# Ballistic Research Labs., Aberdeen Proving Ground, Md.
WORKSHOP REPORT: FUNDAMENTAL REACTIONS IN SOLID PROPELLANT COMBUSTION
Robert A. Fifer May 1979 30 p refs
(DA Proj. 1L1-61102-AH-60)
(AD-A072162; AD-E430263; ARBRL-TR-02166) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report summaries the results of a JANNAF workshop held 26-27 July 1977 at the Ballistic Research Laboratory. The purpose of the workshop was to assess our current understanding of the fundamental chemical and physical processes involved in the ignition and combustion of nitrate ester and nitramine propellants. A brief review is presented of the nitramine slope break and nitrate ester catalysis phenomena. The workshop discussions are summarized. Specific discussion questions are listed, together with some of the ideas and recommendations that resulted from the workshop. GRA

N80-11240# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
THE 84-INCH PROPELLANT GRAINS Final Report, Jan. 1978 - Feb. 1979
Terry V. OHara and Albert J. Martel Edwards AFB, Calif. Air Force Rocket Propulsion Lab. 28 Apr. 1979 91 p
(Contract F04611-78-C-0010; AF Proj. 3059)
(AD-A071961; CSD-2660-FR-D; AFRPL-TR-79-25) Avail: NTIS HC A05/MF A01 CSCL 21/9

This report documents the results obtained during casting a total of 7 84 in. SLSH cartridges with UTP-18,803A propellant (90% solids, 21% aluminum, HTPB) for AFRPL. This program is an extension of the work discussed in AFRPL-TR-77-92 and brings the total amount of UTP-18,803A produced under full-scale production conditions to over 880,000 lb. In addition one ELSH grain was cast with 22,000 lb of UTI-6108, an inert propellant. GRA

N80-11241# Hercules, Inc., Cumberland, Md. Allegany Ballistics Lab.
NAVAL SEA SYSTEM COMMAND RESEARCH AND EXPLORATORY DEVELOPMENT, 1978 Quarterly Summary Report, 10 Nov. 1978 - 30 Jan. 1979
Mar. 1979 49 p
(Contract N00024-79-C-5314)

(AD-A071875; QSR-10) Avail: NTIS HC A03/MF A01 CSCL 21/8

This report describes the progress in the first quarter on the following tasks: Signature Evaluation, Low Cost Strip Laminate Case, Vertical Launch Controllable Motor, Prediction of XLDB Propellant Mechanical Failure, HMX (RDX) Bonding Agents, Polymer Morphology Studies of XLDB Binder. GRA

N80-11242# ARO, Inc., Arnold Air Force Station, Tenn.

INFRARED OPTICAL PROPERTIES OF BIPROPELLANT CRYOCONTAMINANTS Interim Report, 1 Oct. 1977 - 15 Mar. 1979

J. A. Roux, B. E. Wood, and A. M. Smith Arnold AFB AEDC Aug. 1979 123 p refs

(AD-A073186; AEDC-TR-79-50) Avail: NTIS HC A06/MF A01 CSCL 17/5

The infrared spectral transmittance of cryofilms formed by MMH, N2O4, and N2H4 propellants was measured. These films were cryopumped on 20 and 77K germanium substrates and ranged in thickness from 0.25 to 9 microns; the deposition pressure for the films was approximately 1 x 10-7 torr. Transmission spectra were obtained for the 500 to 3700 wavenumber range using a Fourier transform spectrometer. Values of the complex index of refraction for the cryodeposits were derived from the experimental data using an analytical model and a nonlinear least-squares method. The analytical model treats the germanium as a thick, noninterfering film and the deposit as a thin film. Results from the least-squares method are also compared with a Kramers-Kronig determination of the real part of the index of refraction. The optical properties of such cryofilms are essential for predicting the degradation of cryocooled optical surfaces contaminated by liquid propellant exhaust plumes. GRA

N80-11243# Princeton Univ., N. J. Dept. of Electrical Engineering.

THE INFLUENCE OF CONTACT AND INTERFACE EFFECTS OF THE ELECTRONIC PROPERTIES AND STABILITY OF CHEMICALLY UNSTABLE MATERIALS Final Report, 1 Jul. 1974 - 30 Sep. 1978

Peter Mark 23 Jul. 1979 53 p ref

(Grants DAAG29-76-G-0017; DANC04-74-G-0193; Grant DAHC04-75-G-0085)

(AD-A073073; ARO-12606.2-P; ARO-13370.2-P) Avail: NTIS HC A04/MF A01 CSCL 19/1

This report summarizes an effort to assess the usefulness of electron beam probe analysis, such as Auger electron spectroscopy (AES), in the analysis of initiation event in primary explosives, principally, azides. Attempts were made to extract a variety of chemical and physical information from AES analyses of KN and NaN3 crystal specimens to determine whether one could ascribe the chemical instability of these materials to surface as distinct from volume properties. GRA

N80-11244# Exxon Research and Engineering Co., Linden, N.J.

FUNDAMENTAL CHARACTERIZATION OF ALTERNATE FUEL EFFECTS IN CONTINUOUS COMBUSTION SYSTEMS

W. S. Blazowski, R. B. Edelman (Science Applications, Inc., Woodland Hills, Calif.), and P. T. Harsha (Science Applications, Inc., Woodland Hills, Calif.) 11 Sep. 1978 86 p refs

(Contract EC-77-C-03-1543)

(SAN-1543-12) Avail: NTIS HC A05/MF A01

The development of fuel-flexible combustion systems for gas turbines as well as Rankine and Stirling cycle engines is presented. An improved understanding was developed of relationships between alternate fuel properties and continuous combustion system effects, and to provide analytical modeling/correlation capabilities to be used as design aids for development of fuel-tolerant combustion systems. Experimental procedures were evaluated for studying alternate fuel combustion effects and to determine current analytical capabilities for prediction of these effects. Jet Stirred Combustor studies during this period produced new insights into soot formation in strongly back-mixed systems and have provided much information for comparison with analytical predictions. Applications of quasi-global modeling techniques were included as well as comparison of prediction with the experimental results generated. DOE

N80-11245# California Univ., Livermore. Lawrence Livermore Lab.

LABORATORY COAL GASIFIER FACILITY

W. R. Aiman, C. B. Thorsness, and R. J. Cena 16 Apr. 1979 35 p refs Presented at Spring Meeting on Western States Section, and the Combustion Inst., Provo, Utah, 23 Apr. 1979

(Contract W-7405-eng-48)

(UCRL-82602; Conf-790434-3) Avail: NTIS HC A03/MF A01

A laboratory coal gasifier test facility consists of systems for metering gases into an experimental gasifier, condensing the tar and water out of the product gases and flaring them, sampling and analyzing the product gases, and monitoring the gasifier during an experiment. The major items of equipment include: a mass spectrometer, a process gas chromatograph, a mini-computer, and the experimental coal gasifiers--currently a 1.5 m fixed-bed gasifier and a 0.9 m bore-hole gasifier. This facility is described and the use of the facility in validating software and hardware for use in field experiments are discussed. The results of an experiment with the 1.5 m fixed-bed gasifier are described. Temperature profiles down the centerline of the reactor at various times during the experiment are discussed. Product gas compositions are discussed. DOE

N80-11246# Oak Ridge National Lab., Tenn.

ECONOMICS OF GASOLINE PRODUCTION FROM UNDERGROUND COAL GASIFICATION VIA MOBIL-M PROCESS

M. S. Edwards, W. C. Ulrich, and R. Salmon 1979 36 p refs Presented at AICE Meeting, Houston, Tex., 1 Apr. 1979

(Contract W-7405-eng-26)

(CONF-790405-12) Avail: NTIS HC A03/MF A01

A conceptual process design and cost estimate is presented for a facility producing approximately 15,000 barrels per day of M-gasoline via methanol from synthesis gas generated by gasification of coal in situ. The design was based on experimental data obtained at the Laramie Energy Technology Center on the linked vertical well in situ coal gasification process. In-place coal consumption is 756 Mg/h (20,000 tons/day), based on a subbituminous Wyoming coal. The capital investment was estimated to be $535 million in first quarter 1978 dollars. The product price of M-gasoline (including mixed butane LPG) is about $240/cubed m ($0.90/gas) at the plant gate. Calculated overall thermal efficiency for the facility was 22%, based on in-place coal. DOE

N80-11247# California Univ., Livermore. Lawrence Livermore Lab.

BEHAVIOR OF LIGHTLY CONFINED HIGH EXPLOSIVES IN A JET-FUEL FIRE

K. J. Scribner and G. J. Tanaka 2 Feb. 1979 23 p

(Contract W-7405-eng-48)

(UCRL-52659) Avail: NTIS HC A02/MF A01

The effects of a jet-fuel fire on the behavior of several plastic-bonded explosives of military interest were investigated. Eight small spherical explosive assemblies cased in stainless steel and containing thermocouples to record the ambient flame temperature at several points inside the assembly were fabricated. The explosive formulations contained HMX, TATB, NQ, or combinations of HMX with either TATB or NQ. When these units were tested, similar behavior for all formulations was observed. There were no detonations. Decomposition began at the outer surface of the high-explosive charge and proceeded slowly toward the center, and all casings vented under the pressure of the decomposition products. Thermograms showed that, under the test conditions, TATB is the most thermally stable and NQ is the least stable of the three explosives tested. DOE

N80-11248# Metal Properties Council, Inc., New York.

PROGRAM TO DISCOVER MATERIALS SUITABLE FOR SERVICE UNDER HOSTILE CONDITIONS OBTAINING IN EQUIPMENT FOR THE GASIFICATION OF COAL AND OTHER SOLID FUELS Quarterly Progress Report, 1 Apr. 1978 - 30 Jun. 1978

A. O. Schaefer, ed. DOE 16 Oct. 1978 238 p refs

(Contract EX-76-C-01-1784)

(FE-1784-42) Avail: NTIS HC A11/MF A01

Progress is reported in screening materials for use in such plants with corrosive environments and in providing useful corrosion data as well as reliable information on other properties needed for the design, construction, and operation of such plants. The program involves high temperature corrosion studies involving low concentration of H2S, exposure of metal coupons and refractories in coal gasification pilot plants, aqueous corrosion erosion and corrosion testing, and measurements of the mechanical and physical properties of materials. DOE

N80-11249# Institute of Gas Technology, Chicago, Ill.
RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS (RISER CRACKING OF COAL) Quarterly Report, 1 Apr. - 30 Jun. 1978
D. A. Duncan, J. L. Beeson, and R. D. Oberle Sep. 1978 25 p refs
(Contract EX-76-C-01-2307)
(FE-2307-38; QR-1) Avail: NTIS HC A02/MF A01

Runs were made in the bench-scale unit to investigate hydrocarbon yields from North Dakota lignite at operating pressures of 500 and 1000 psig. The base carbon conversions were reduced to approximately 26 and 33%, and hydrocarbon liquids yields were reduced to 6.4 and 9.2 grams per 100 grams of feed carbon, respectively. These values are considerably lower than those obtained from North Dakota lignite in bench-scale unit operations at 2000 psig. At that pressure, base carbon conversions were approximately 50%, and hydrocarbon liquids yields were 18 grams per 100 grams of feed carbon. Runs were also made with Illinois No. 6 bituminous coal [free-swelling-index (FSI) = 4-1/2]. To avoid plugging the reactor, the coal was mixed with fine silica sand at levels of 10%, 20%, and 30% (by weight) coal with sand. The bench-scale unit was operated using an upsweeping temperature profile at coil outlet temperatures of 1450 and 1500 F and a system outlet pressure of 2000 psig. Runs with the 10% and 20% (by weight) coal were successful. DOE

N80-11250# Electric Power Research Inst., Palo Alto, Calif.
BIOFUELS: A SURVEY
John R. Benemann Jun. 1978 96 p refs Sponsored by EPRI
(EPRI-ER-746-SR) Avail: NTIS HC A05/MF A01

Photosynthesis, plant productivity, waste and residue resources, 'energy farming,' processes for using biomass directly or converting it to fuels, and overall economics are discussed. Applications by U.S. industries and utilities are emphasized and current U.S. research and development programs presented. With foreseeable technologies and economics, approximately 5% of the fossil fuels now consumed in the United States could presently be replaced by available forestry, agricultural, and municipal wastes and residues. DOE

N80-11251# Department of Energy, Washington, D. C. Energy Policy Office.
NATIONAL GAS SURVEY REPORT TO THE FEDERAL ENERGY REGULATORY COMMISSION BY THE SUPPLY-TECHNICAL ADVISORY TASK FORCE ON NONCONVENTIONAL NATURAL GAS RESOURCES
Jun. 1978 116 p refs
(DOE/FERC-0010) Avail: NTIS HC A06/MF A01

An analysis of the future energy situation in the U.S. with emphasis on the natural gas industry is presented. The analysis includes chapters on historical research efforts, industry criteria for commercialization of coal bed gas, technology for recovering methane from coal beds, identification of problems, legal concerns, and environmental considerations. DOE

N80-11252# Toulouse Univ. (France).
DETONATION OF EXPLOSIVES USING SEMICONDUCTING LAYERS [INITIATION D'EXPLOSIVES A COUCHES SEMICONDUCTRICES]
J. F. Vincent Jul. 1978 20 p ref In FRENCH
(Publ-368) Avail: NTIS HC A02/MF A01

Nonlinear layers to be combined with appropriate detonators for the electrical firing of explosives were developed in order to provide an elevation of the low voltage safety limit and a reduction of the operating point dispersion. Indirect operation in series with a conductive initiator and direct operation producing detonation by primary current heating of the nonlinear layer were investigated. The materials under study were OZN ceramics with the addition of 0.5 percent of Bi203 (binary system) and the same with the addition of 0.5 percent MnO2 (tertiary system). Results show that using a 100 nF condenser, an operation point of 150 volts with a + or - dispersion of 10 volts with the tertiary system is possible for indirect firing, while 400 volts and 1000 nF are necessary for direct firing. Author (ESA)

N80-11253# Prins Maurits Lab. TNO, Rijswijk (Netherlands). Inst. voor Chemische en Technologische Research.
SURVEY OF THE ACTIVITIES CONCERNING SENSITIVITY TEST METHODS FOR EXPLOSIVES
I. J. J. Janswoude 22 Aug. 1978 32 p refs
(Contract A76/KL/071)
(PML-1979-20; TDCK-71984) Avail: NTIS HC A03/MF A01

A survey of sensitivity test methods for explosives as used by an explosion safety laboratory is presented. The survey includes sensitivity methods regarding impact, friction, sparks, hot surfaces, and the importance and applications of critical hot spot size theory. Author (ESA)

N80-11254# New York City Resource Recovery Task Force, N. Y.
METHANE RECOVERY FROM SANITARY LANDFILLS: GAS RECOVERY SYSTEM INSTALLATION AND TESTING Interim Report
Dec. 1978 45 p refs Prepared in cooperation with Brooklyn Union Gas Co., N. Y. and Wegman Co., Inc., Buffalo, N. Y.
(PB-298622/4; NYSERDA-78/18) Avail: NTIS HC A03/MF A01 CSCL 21D

A methane gas recovery program to mine this clean energy form from the municipal solid wastes deposited at the New York Fresh Kills Landfill in Staten Island, New York is described. Optics covered include the results of a six-week test program subsequent modifications made to the gas system, and the objectives and plans for the phase 3 landfill gas utilization program. GRA

N80-11255# Mitre Corp., McLean, Va. Metrek Div.
ASSESSMENT OF LONG TERM RESEARCH NEEDS FOR COAL-GASIFICATION TECHNOLOGIES Final Report
Apr. 1979 201 p
(Contract ER-78-C-01063)
(PB-297853/4; MTR-79W00160) Avail: NTIS HC A10/MF A01 CSCL 07A

An assessment of research areas that affect long term development of coal gasification technologies is presented. Research recommendations and findings are discussed. Included are: an analysis of the major application areas for coal gasification technologies; discussion of the status and needs of the principal systems according to reactor type (fixed bed, fluidized bed, etc.); reports from site visits and communications with technology developers; and in-depth assessment of basic research needs in the critical areas of scaling and modeling, materials, effluent characterization, diagnosis and instrumentation, coal chemistry, catalytic chemistry, gas particle systems, and unit operations. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-11256# Forecasting International Ltd., Arlington, Va.
U. S. ARMY METRICATION ANALYSIS AND RECOMMENDATIONS FOR DA IMPLEMENTATION PLAN, VOLUME 1
M. J. Oetron, L. A. Roepcke, C. F. McFadden, S. E. Sugarek, and E. B. Peters 9 Jun. 1978 345 p refs
(Contract DAAG39-77-C-0108)
(AD-A069746) Avail: NTIS HC A15/MF A01 CSCL 05/1

Much has been learned about the metrication experiences and practices of foreign nations and U.S. companies. The most

crucial lessons learned from the experience of others which have relevance to the U.S. Army are briefly summarized below. (1) Metrication is inevitable. (2) Key to the Army's approach to metrication should be an evolutionary, least cost philosophy - including the concepts of keeping pace with industry, letting costs lie where they fall and employing flexible timetables and plans. (3) A strong, high level commitment to metrication is essential. (4) Planning and coordination are the keys to successful, least cost metrication, and the 'doers' (line management) should be the planners. (5) Only a small, dedicated metrication organization is needed. It can be supported by ad hoc working groups with membership drawn from the line organization. GRA

N80-11257# Army Aviation Research and Development Command, St. Louis, Mo.
SCHEDULE: MANAGERIAL TOOL FOR PROJECT/PRODUCT MANAGERS Final Report
Vernon Allen, Lonnie Antwiler, and Michael Garsik May 1979 195 p refs
(AD-A072140; USAAVRADCOM-TR-79-17) Avail: NTIS
HC A09/MF A01 CSCL 09/2

Schedule is an interactive computer program designed to organize and present schedule information. It enables the user to maintain a master file of schedule type information for each of many projects, from which current status, change impact analysis or 'what if' studies can be obtained. The program, which was developed on an IBM 360/65, provides graphic output on a Tektronix 4014 or tabular output on most printers/typewriters. It was written in PL/1 language except for the graphics routines, which are combinations of Fortran IV and Tektronix Advanced Graphics, Release 3. GRA

N80-11258# Army Construction Engineering Research Lab., Champaign, Ill.
THE BUILDING LOADS ANALYSIS AND SYSTEM THERMODYNAMICS (BLAST) PROGRAM, VERSION 2.0. USERS MANUAL, VOLUME 1 *Final Report*
Douglas C. Hittle Jun. 1979 287 p
(AD-A072272; CERL-TR-E-153-Vol-1) Avail: NTIS
HC A13/MF A01 CSCL 09/2

The Building Loads Analysis and System Thermodynamics (BLAST) program is a comprehensive set of subprograms for predicting energy consumption in buildings. There are three major subprograms: (1) the space load predicting subprogram, which computes hourly space loads in a building or zone based on user input and hourly weather data; (2) the air distribution system simulation subprogram, which uses the computed space load and user inputs describing the building air-handling system to calculate hot water or steam, chilled water, and electric energy demands; and (3) the central plant simulation program, which simulates boilers, chillers, onsite power generating equipment and solar energy systems and computes monthly and annual fuel and electrical power consumption and plant life cycle cost. GRA

N80-11259# Army Construction Engineering Research Lab., Champaign, Ill.
THE BUILDING LOADS ANALYSIS SYSTEM THERMODYNAMICS (BLAST) PROGRAM, VERSION 2.0. INPUT BOOKLET *Final Report*
E. Sowell Jun. 1979 118 p
(AD-A072435; CERL-TR-E-153) Avail: NTIS
HC A06/MF A01 CSCL 09/2

The Building Loads Analysis and System Thermodynamics (BLAST) program is a comprehensive set of subprograms for predicting energy consumption in buildings. There are three major subprograms: (1) the space load predicting subprogram, which computes hourly space loads in a building or zone based on user input and hourly weather data; (2) the air distribution system simulation subprogram, which uses the computed space load and user inputs describing the building air-handling system to calculate hot water or steam, chilled water, and electric energy demands; and (3) the central plant simulation program, which simulates boilers, chillers, onsite power generating equipment and solar energy systems and computes monthly and annual fuel and electrical power consumption and plant life cycle costs. GRA

N80-11260# Pennsylvania State Univ., University Park. Applied Research Lab.
DEVELOPMENT EFFORTS ON A DIFFUSER AND PUMP INLET FOR A WATER JET PROPULSION SYSTEM
A. M. Yocum 4 Apr. 1979 88 p refs
(Contract N00024-79-C-6043)
(AD-A072567; ARL/PSU/TM-79-51) Avail: NTIS
HC A05/MF A01 CSCL 13/10

Results from three studies relating to the development of a water jet propulsion system for a high speed planing craft are presented. More specifically, these studies apply to the development of the diffuser and pump inlet of the system and represent a continuation of previous work done at ARL/PSU in this area. The first study investigates the possible interaction of the flow between the diffuser and a vaned-volute type pump inlet. No interaction was revealed. The second study determined the feasibility of an improved vaned-volute type inlet using conventional pump design techniques to lay out the vanes. With the restrictions placed on the design by the propulsion system, flow separation from the vanes is likely and, thus, this type of inlet was found to be infeasible. The third study consisted of the design and model testing of a new diffuser and a conventional double suction pump inlet. The design and test results are documented in this report. Test results showed that the diffuser efficiency was improved slightly and the losses through the pump inlet were reduced by more than a factor of two from the losses in the vaned-volute inlet. GRA

N80-11261# Sandia Labs., Albuquerque, N. Mex.
EXPLOSIVE TECHNIQUE FOR AXISYMMETRIC EXPANSION OF CYLINDERS AT HIGH STRAIN RATES
R. I. Butler, B. W. Duggin, and M. J. Forrestal Jan. 1979 17 p refs
(Contract EY-76-C-04-0789)
(SAND-78-2393) Avail: NTIS HC A02/MF A01

Dry PETN high explosive which was vibrated into an annular cavity and surface initiated with a mesh pattern of etched copper bridgewires was used to expand type 304 stainless steel cylinders through fracture at initial strain rates of approximately 2700/s. This technique produced a uniform detonation that was simultaneous to within 100 ns over the loaded surface. DOE

N80-11262# Bendix Corp., Kansas City, Mo.
ELECTROCHEMICAL DEBURRING: ANOTHER SHARP SWORD IN THE BATTLE WITH BURRS
LaRoux K. Gillespie 1979 35 p
(Contract EY-76-C-04-0613)
(BDX-613-2132) Avail: NTIS HC A03/MF A01

A technology assessment of the process of electrochemical deburring (ECD) is presented. ECD is a process which uses both electricity and chemistry to remove burrs. It is a very fast process suitable to a wide range of metals. It is one of the few processes which does not require a tool which cuts, scrapes, abrades, or otherwise touches the burr. Some of its best applications are with materials or configurations which are not easily deburred by any other process. DOE

N80-11263# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
A MODEL FOR NONLINEAR CREEP OF CONCRETE
J. H. Argyris, K. S. Pister, and K. J. William Apr. 1978 14 p refs Presented at 2d Session of RILEM Colloq. on Creep Concrete, Leeds, Engl., 20-21 Apr. 1978
(ISD-Rept-246) Avail: NTIS HC A02/MF A01

A constitutive model for uniaxial creep of concrete, based on thermodynamics of materials with internal state variables is described. Using experimental data, model parameters are estimated using least squares procedures. It is found that considerable nonlinearity with respect to stress exists in instantaneous creep response, that recoverable creep strain is relatively insensitive to aging, and that irreversible creep strain is relatively strongly affected by aging and stress level. A brief discussion of important open questions concerning choice of models for creep is included. Author (ESA)

N80-11264# Uppsala Univ. (Sweden). Inst. of Technology.
DESORPTION HEAT CAPACITY OF 3He ADSORBED ON SOLID ARGON

Per Wennerstroem, Anders Toerne, and Torsten Lindqvist Mar. 1978 14 p refs
(UPTEC-78-16-R) Avail: NTIS HC A02/MF A01

The desorption heat capacity of successive monolayers of 3He absorbed on solid argon was measured and a rigid band model for the adsorption states was used in the analysis. Results show that the desorption energy for the first layer varies from -90 K to -38 K as a function of coverage. For the second layer the model shows that the first adatoms in this layer have thermodynamic properties very similar to the last atoms in the first layer. Author (ESA)

N80-11265# Uppsala Univ. (Sweden). Inst. of Technology.
DESORPTION HEAT CAPACITY OF 4He ADSORBED ON SOLID NEON
Anders Toerne, Per Wennerstroem, and Torsten Lindqvist Mar. 1978 10 p refs
(UPTEC-78-17-R) Avail: NTIS HC A02/MF A01

The desorption heat capacity of successive monolayers of 4He adsorbed on solid neon was measured and a rigid band model for the adsorption was used in the analysis. The desorption energy for the first layer varies from -66 K to -29 K as a function of coverage. The desorption process is described using Fermi-Dirac statistics although the adatoms are bosons.
Author (ESA)

N80-11266# Uppsala Univ. (Sweden). Inst. of Technology.
DESCRIPTION OF EXPERIMENTAL TECHNIQUES USED IN HEAT CAPACITY MEASUREMENTS OF ADSORBED HELIUM
Anders Toerne, Per Wennerstroem, and Torsten Lindqvist Mar. 1979 14 p refs
(UPTEC-78-18-R) Avail: NTIS HC A02/MF A01

Calorimeters and methods for heat capacity measurements of helium adsorbed on inert gas crystals are described. Nitrogen and helium isotherms are presented. Data collection and handling are described. Author (ESA)

N80-11267# Uppsala Univ. (Sweden). Inst. of Technology.
HEAT CAPACITY OF SUBMONOLAYERS OF 3He ADSORBED ON SOLID NEON
Per Wennerstroem, Anders Toerne, and Torsten Lindqvist Mar. 1978 17 p refs
(UPTEC-78-31-R) Avail: NTIS HC A02/MF A01

The heat capacity of 3He adsorbed on solid neon was measured for coverages from 1% of monolayer capacity to a complete monolayer with high resolution. Results show that the desorption heat capacity has a maximum at 7 K. At predesorption temperatures the heat capacity is linear and coverage dependent. The heat capacity of the lowest coverages has an anomalous behavior below 0.7 K. Author (ESA)

N80-11268# Transportation Research Board, Washington, D.C.
ANALYSIS OF PAVEMENT SYSTEMS
Michael I. Darter, Thomas W. Kennedy, Amir M. Tabatabaie, Ernest J. Barenberg, and Y. H. Huang 1978 104 p
(PB-298098/5; TRB/TRR-671; ISBN-0-309-02811-6) Avail: NTIS HC A06/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., N.W., Washington, D. C. 20418, HC $5.40 CSCL 13B

Fourteen papers are presented which discuss the following areas: (1) structural design for concrete pavement; (2) pavement design characteristics; (3) fatigue behavior of concrete; (4) prediction of pavement distress (abridgement); and (5) design and behavior or soil-fabric-aggregate systems. GRA

N80-11269# Transportation Research Board, Washington, D.C.
GEOMETRICS, HYDRAULICS, AND HYDROLOGY
V. F. Hurdle (Toronto Univ., Ontario), Joseph Craus (Transportation Res. Inst.), Moshe Livneh (Technion-Israel Inst. of Tech., Haifa), Edward R. Post (Nebraska Univ., Lincoln), Patrick T. McCoy (Nebraska Univ., Lincoln), Richard J. Ruby (Nebraska Dept. of Roads), David O. Coolidge (Nebraska Dept. of Roads), Patrick Shannon (Boise State Univ.), Alohn Stanley (Idaho Transportation Dept.), Kumares C. Sinha (Purdue Univ.) et al 1978 49 p refs
(PB-298102/5; TRB/TRR-685; ISBN-0-309-0230-2) Avail: NTIS HC A03/MF A01; also available from Transportation Research Board, 2101 Constitution Ave., N.W., Washington, D. C. 20418 HC $3.00 CSCL 13B

Contents: edge-of-pavement profiles; superrelevation and curvature of horizontal curves; cost-effectiveness of driveway slope improvements; pavement width standards for rural two-lane highways (abridgement); earth berms and their actual and perceived effects on noise and privacy in adjacent neighborhoods; hydraulic and safety characteristics of selected grate inlets (abridgement); determining design flows for culverts and bridges on ungauged streams: a watershed rationale (abridgement); and rainfall intensity-duration-frequency curves developed from (not by) computer output. GRA

N80-11021 Allerton Press, Inc., New York, N. Y.
ON THE DAMPING EFFECT IN SURFACE PLASTIC DEFORMATION
P. G. Balyura *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 103-106 refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 126-129
(For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N80-11270 British Broadcasting Corp., Kingswood (England). Research Dept.
SATELLITE BROADCASTING: RESULTS OF A PRELIMINARY COVERAGE SURVEY IN THE UK
R. V. Harvey Sep. 1979 13 p refs
(BBC-RD-1979/18) Avail: British Broadcasting Corp., Kingswood Warren, Tadworth, Surrey, England

In order to discover the types and extent of local obstructions to domestic reception of future satellite broadcast transmissions to the UK, a questionnaire was distributed to a limited number of the staff of organizations concerned with broadcasting. The report describes the basis for the survey, and gives an analysis of the results; it is estimated that the loss of possible coverage by individual reception, through shadowing of all parts of the premises occupied, would be less than 0.5% of the population. Author

N80-11271 British Broadcasting Corp., Kingswood (England). Research Dept.
DIGITAL SOUND: SAMPLING-RATE SYNCHRONISATION BY VARIABLE DELAY
N. H. C. Gilchrist Sep. 1979 9 p refs
(BBC-RD-1979/17) Avail: British Broadcasting Corp., Kingswood Warren, Tadworth, Surrey, England

In a situation where a number of digital sound signals, all from sources operating at nominally the same sampling frequency, need to be processed, a variable delay technique may be used to synchronize the signals at the input to the processor. Experimental equipment is described which changes the sampling rate of a digital sound signal by using a variable delay which is automatically reset during program pauses. Listening tests indicate that the adjustment of sampling rates by a small amount using this technique can be achieved with little or no impairment to the sound signal. Author

N80-11272*# National Aeronautics and Space Administration, Washington, D. C.
PROSPECTS AND LIMITATIONS FOR USE OF FREQUENCY SPECTRUM FROM 40 TO 300 GHz
Clarence E. Catoe [1979] 11 p refs
(NASA-TM-80812) Avail: NTIS HC A02/MF A01 CSCL 17B

The existing and future use of the electromagnetic spectrum

from 40 to 300 gigahertz is discussed. The activities envisioned for this segment of the electromagnetic spectrum fall generically into two basic categories: communications and remote sensing. The communications services considered for this region are focused on the existing and future frequency allocations that are required for terrestrial radio services, space to ground radio services, space to space radio services, and space to deep space radio services. The remote sensing services considered for this region are divided into two groups of activities: earth viewing and space viewing. A.W.H.

N80-11273# National Aviation Facilities Experimental Center, Atlantic City, N. J.
VOICE DATA ENTRY IN AIR TRAFFIC CONTROL Report, May 1976 - Dec. 1978
Donald W. Connolly Aug. 1979 76 p refs
(FAA Proj. 219-151-100)
(AD-A073670; FAA-NA-79-20) Avail: NTIS
HC A05/MF A01 CSCL 17/2

The potential operational utility of state-of-the-art word recognition technology in air traffic control applications were studied. Experiment 1, employing 12 operators or talkers, secured baseline data representing the inherent best case recognition accuracy of the system. Three of the subvocabularies of an operational data entry language were tested exhaustively to a total of over 46,000 spoken words. On the average, across all speakers and all three subvocabularies, only 1 percent of the words spoken were erroneously recognized. Subsequent tuning of the recognition algorithm reduced the error rate to less than 0.4 percent. Experiment 2 compared the quality and efficiency of the voice system versus the existing keyboard method of entering complete operational messages. The voice system produced 64 percent fewer errors of all kinds than the keyboard in the messages entered, but showed no advantage (or disadvantage) in rate of entry. Voice entry, however, did demonstrate an advantage in the overall time consumed by the data entry process - less time was required to translate entry requirements into the spoken language than into the keyboard code. Other influential factors were also examined, including the effects of microphone type, individual differences between operators, the stability of operators' word-prints over time, and operator adaptation to the voice entry system. F.O.S.

N80-11274# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
PROVISIONAL MESSAGE FORMATS FOR THE DABS/NAS INTERFACE Final Report
Apr. 1979 42 p refs
(AD-A073461; FAA-RD-74-63B-Rev-2) Avail: NTIS
HC A03/MF A01 CSCL 17/2

Formats for messages which are to be transmitted between DABS and NAS facilities (en route or terminal) are defined. These messages include one-way Surveillance Reports to NAS and two-way Communications Messages. The latter support data link functions between NAS and DABS-equipped aircraft, as well as aiding in the monitoring and control of DABS sensors. These message formats are to be used in the design and construction of interface equipment and ground data links for engineering model system test and evaluation at NAFEC during Phase 2 of the DABS Development Program; and with modifications resulting from this test and evaluation effort, the basis for the operational implementation of DABS is formed. M.M.M.

N80-11275# IIT Research Inst., Annapolis, Md.
EVALUATION OF TRANSPONDER ANTENNA COVERAGE/ ATCRBS DURING SIMULATED FLIGHTS OF AIRCRAFT Final Report
Thomas Gibson Apr. 1979 73 p refs
(Contracts DOT-FA70WAI-175; F19628-78-C-0006)
(AD-A073547; ECAC-PR-76-019; FAA-RD-77-122) Avail: NTIS HC A04/MF A01 CSCL 17/9

A computer model was used to analyze the effect of aircraft orientation on the performance of the Air Traffic Control Radar Beacon System (ATCRBS). Flights by Cessna 150, Boeing 727, Boeing 747, and F-4H aircraft over a common flight route out of La Guardia Airport were simulated. Transponder/antenna performance for various aircraft attitudes and locations along the flight path was analyzed with respect to interrogators located at JFK airport. This performance was compared to a transponder having ideal, omni-directional antenna coverage to illustrate the degree to which the combination of aircraft orientation and transponder antenna pattern may affect ATCRBS performance. Author

N80-11276# National Mechanical Engineering Research Inst., Pretoria (South Africa). Strength Mechanics Div.
PROGRAM PSD: DIGITAL DETERMINATION OF POWER SPECTRAL DENSITIES OF RANDOM SIGNALS
J. T. D. Fritz Oct. 1978 52 p refs
(CSIR-ME-1594; ISBN-0-7988-1460-8) Avail: NTIS
HC A04/MF A01

The algorithm and procedure for the digital determination of power spectral densities from random signals are described. The program yields power spectra with a frequency range resolution of (1/256)f(MAX). Floating point arithmetic utilizing Varian supplied software is used with a consequent relatively long execution time of 210 seconds per analysis. This, however, is not a very serious drawback as the program was constructed to enable batch analyses to be carried out and can thus be run overnight. A significant improvement on execution time can be obtained by changing the program to fixed point double precision arithmetic. Should an even shorter execution time be desirable, the program must be rewritten to utilize the so-called Fast Fourier Transform algorithm. Author

N80-11277*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
CONCEPTS FOR 18/30 GHz SATELLITE COMMUNICATION SYSTEM, VOLUME 1 Final Report
R. Jorasch, M. Baker, R. Davies, L. Cuccia, and C. Mitchell 1 Nov. 1979 169 p 3 Vol.
(Contract NAS3-21362)
(NASA-CR-159625-Vol-1; WDL-TR8457-Vol-1) Avail: NTIS
HC A08/MF A01 CSCL 17B

Concepts for 18/30 GHz satellite communication systems are presented. Major terminal trunking as well as direct-to-user configurations were evaluated. Critical technologies in support of millimeter wave satellite communications were determined. M.M.M.

N80-11278*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
CONCEPTS FOR 18/30 GHz SATELLITE COMMUNICATION SYSTEM, VOLUME 1A: APPENDIX Final Report
R. Jorasch, M. Baker, R. Davies, L. Cuccia, and C. Mitchell 1 Nov. 1979 181 p refs 3 Vol.
(Contract NAS3-21362)
(NASA-CR-159625-Vol-1A; WDL-TR8457-Vol-1A) Avail: NTIS
HC A09/MF A01 CSCL 17B

The following are appended: (1) Propagation phenomena and attenuation models; (2) Models and measurements of rainfall patterns in the U.S.; (3) Millimeter wave propagation experiments; (4) Comparison of theory and experiment; (5) A practical rain attenuation model for CONUS; (6) Space diversity; (7) Values of attenuation for selected U.S. cities; and (8) Additional considerations. M.M.M.

N80-11279*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
CONCEPTS FOR 18/30 GHz SATELLITE COMMUNICATION SYSTEM STUDY. EXECUTIVE SUMMARY
M. Baker, R. Davies, L. Cuccia, and C. Mitchell 1 Nov. 1979 36 p 3 Vol.
(Contract NAS3-21362)
(NASA-CR-159680; WDL-TR8457) Avail: NTIS
HC A03/MF A01 CSCL 17B

An examination of a multiplicity of interconnected parameters ranging from specific technology details to total system economic costs for satellite communication systems at the 18/30 GHz transmission bands are presented. It was determined that K sub A band systems can incur a small communications outage during very heavy rainfall periods and that reducing the outage to zero would lead to prohibitive system costs. On the other hand, the economics of scale, ie, one spacecraft accommodating 2.5 GHz of bandwidth coupled with multiple beam frequency reuse, leads

to very low costs for those users who can tolerate the 5 to 50 hours per year of downtime. A multiple frequency band satellite network can provide the ultimate optimized match to the consumer performance/economics demands. - M.M.M.

N80-11280*# National Aeronautics and Space Administration, Washington, D. C.

ANTENNA OF THE SPACE RADIOTELESCOPE KRT-3

V. I. Kostenko and L. I. Matveyenko Nov. 1979 22 p refs Transl. into ENGLISH of Antenna Kosmicheskogo Radioteleskopa KRT-3 (Moscow), PR-340, 1977 20 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Academy of Sciences (USSR), Moscow

(Contract NASw-3199)

(NASA-TM-75714) Avail: NTIS HC A02/MF A01 CSCL 09C

The questions of antenna design with a diameter of 3 m for space radio-interferometry are examined. The basic characteristics of the antenna are determined, on the basis of which a model of the antenna of a space radiotelescope of 3.1 m KRT-3 is developed and prepared. The technological peculiarities of the antenna preparation are examined. The results of measurement of the reflecting surfaces of the telescope are cited, which point to the fact that the antenna may operate to wave lengths in the order of 2 mm. Author

N80-11281# General Electric Co., Syracuse, N.Y. Heavy Military Equipment Dept.

RADAR DETECTION CALCULATIONS WITH THE HP-65 AND HP-67

M. A. Johnson May 1979 71 p refs

(AD-A071609; R79EMH5) Avail: NTIS HC A04/MF A01 CSCL 17/7

Card programmable calculators together with suitable programs can easily provide numerical answers which formerly took large computers and volumes of tabular or plotted outputs for everyday reference. Presented here are derivations and program listings for the HP-65 and HP-67 calculators to provide the user with commonly used radar detection performance data. Both fixed threshold and adaptive threshold CFAR detection with noncoherent integration are covered. Recursive programs for the general chi-squared target fluctuation distribution are treated as well as faster running recursive programs for the Swerling target Cases I - IV. Also included are fast programs for the required detection signal-to-noise ratio based on the simplified algorithms of Barton. GRA

N80-11282# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.

MESSAGE SERVICES IN COMPUTER NETWORKS

Franklin F. Kuo 1978 9 p refs

(Contract N00014-78-C-0498)

(AD-A071730) Avail: NTIS HC A02/MF A01 CSCL 17/2

In this paper we discuss the key issues in the generation and distribution of messages in a computer network. The principal issues are: user support, privacy and security, addressing, and standards and regulations. Examples of current message systems on the ARPANET are discussed. GRA

N80-11283# Hughes Research Labs., Malibu, Calif.

INTELLIGENT BANDWIDTH COMPRESSION Quarterly Report, 1 Nov. 1978 - 31 Jan. 1979

D. Y. Tseng, B. L. Bullock, J. D. Olsen, and K. E. Olin Jun. 1979 58 p refs

(Contract DAAK70-78-C-0148)

(AD-A071692; QPR-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

This is the first quarterly technical progress report for the Intelligent Bandwidth Compression (IBC) program (DAAK70-78-C-0148). The report describes the results of the first three months of a seven-month technical effort to develop techniques and algorithms for achieving a 1,000:1 bandwidth compression in image data transmission rate for RPV applications. The period covered by this report is 1 November 1978 to 31 January 1979. GRA

N80-11284# State Univ. of New York at Buffalo.

AN EXPERIMENTAL INVESTIGATION OF THE REDUCTION OF NONLINEAR EFFECTS USING PASSIVE COMPENSATING NETWORKS Progress Report, Oct. 1977 - Sep. 1978

Carmen A. Paludi, Jr. and James J. Whalen Jun. 1979 83 p refs

(Contract F30602-75-C-0122; AF Proj. 2338)

(AD-A072422; RADC-TR-79-148) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report describes an experimental investigation to determine if a procedure reported upon for reducing third order Intermodulation Products (IMP's) in an RF amplifier stage could be implemented in the laboratory. The third order IMP reduction procedure is based upon altering the RF amplifier linear out-of-band response by adding passive compensating networks. For this experiment, an RF amplifier tuned at 10 MHz was selected. The RF amplifier was excited by two CW signals at frequencies f1 = 9.0 MHz and f2 = 9.5 MHz in order to obtain a third order IMP at the frequency 2f2 - f1 = 10 MHz. The objective of the experiment was to determine if a significant reduction in this third order IMP could be obtained by connecting properly designed compensating networks to the basic RF amplifier stage. A linear model for the basic RF amplifier stage was developed. This model yielded calculated results that were in relatively good agreement with measured results for the magnitude and phase of the linear transfer function VOUT/VIN. Using the linear model for the basic amplifier stage, compensating networks were synthesized. GRA

N80-11285# Naval Surface Weapons Center, White Oak, Md.

HIGH EXPLOSIVE DETONATION AND ELECTROMAGNETIC INTERACTION Technical Report, Sep. 1977 - Jul. 1978

Edward T. Toton 30 Mar. 1979 35 p refs

(ZR0000101)

(AD-A072577; NSWC/WOL/TR-79-205) Avail: NTIS HC A03/MF A01 CSCL 19/4

The effect of stationary, uniform, electric, and magnetic fields on steady-state detonation of condensed explosives is studied. The electrical conductivity profile in the region of the reaction zone provides a current path and Joule heating. Expected increases of detonation velocity and pressure by Joule heating are computed using an Abel equation of state. It is shown that the detonation pressure of TNT can be increased by as much as 12% and detonation velocity by as much as 6% before electrical breakdown can occur. GRA

N80-11286# Range Commanders Council, White Sands Missile Range, N. Mex. Safety Group.

TEST PROCEDURE FOR C-BAND NONCOHERENT RADAR TRANSPONDER

1979 46 p

(AD-A072069; RSG-310-79) Avail: NTIS HC A03/MF A01 CSCL 17/9

The purpose of this document is to delineate types of tests and test procedures for radar transponder qualification, flight certification, and preflight readiness as required for support of test programs at the national ranges. The test procedures are general in type but are intended for standardization within the national ranges. Qualification or flight certification of a transponder by a national range does not necessarily mean that it is acceptable for all other ranges because each range has its own tracking and range safety responsibilities which, by their very nature, cannot be delegated. This document, however, outlines the test requirements and procedures for standardization at all national ranges. GRA

N80-11287# Booz-Allen and Hamilton, Inc., Bethesda, Md. Communications and Information Technology Div.

CATEGORIZATION AND SPECIFICATION REQUIREMENTS FOR A COMMON FAMILY OF AUTODIN TERMINALS Final Report

W. Landis, S. Garber, and R. Latner 1 May 1979 78 p refs

(Contract DCA100-77-C-0057)

(AD-A072164; AD-E100247) Avail: NTIS HC A05/MF A01 CSCL 17/2

This report presents results of an analysis conducted to determine specification requirements for a common family of AUTODIN terminals. It defines a set of standard terminal functions, describes a set of terminal categories and identifies which functions in each category must be defined further, and specified to ensure

consistency with the Integrated AUTODIN System Architecture.
GRA

N80-11289# Booz-Allen and Hamilton, Inc., Bethesda, Md. Communications and Information Technology Div.
INTEGRATED AUTODIN SYSTEM (IAS): GENERATION OF VIABLE FAR-TERM ARCHITECTURES FOR IAS Final Report
Stefan Shrier and P. Torelli 1 Jun. 1979 37 p refs
(Contract DCA100-77-C-0057)
(AD-A072165; AD-E100248) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report presents an implementation of a methodology for the synthesis and ranking of logical architectures. The purpose of the methodology is to generate in a plausible manner, those logical architectures that lead to the identification and selection of candidate network architectures. GRA

N80-11290# Royal Australian Navy Research Lab., Edgecliff.
ON SURFACE-BASED ADVECTIVE RADAR DUCTS
Phillip J. Mulhearn Dec. 1978 29 p refs
(AD-A071454; RANRL-TN-5/78) Avail: NTIS HC A03/MF A01 CSCL 17/9

As a warm, well mixed air mass flows off a land surface and over a cooler sea, the air is modified in a layer near the surface. Within this layer humidity decreases while temperature increases with height and a radar duct is formed. The non-dimensional parameters governing the growth of the modified layer are derived and simple forms are found for the increase of layer height with fetch and for the shapes of humidity and temperature profiles. From these relations the depth and strength of the radar duct are derived as functions of the modified layer depth and the differences in potential temperature and water vapor pressure between the overland air mass and air in thermodynamic equilibrium with the sea surface. GRA

N80-11291# Lincoln Lab., Mass. Inst. of Tech., Lexington.
TECHNOLOGY ASSESSMENT FOR FUTURE MILSATCOM SYSTEMS: THE EHF BANDS
David J. Frediani 12 Apr. 1979 294 p refs
(Contract F19628-78-C-0002)
(AD-A071896; DCA-5; ESD-TR-79-43) Avail: NTIS HC A13/MF A01 CSCL 17/2

Severe crowding of the radio frequency spectrum and of the geostationary orbital arc, coupled with DoD requirements for increased bandwidth, motivate a transition of future MILSATCOM systems to operating frequencies between 20 and 50 GHz (EHF). The identification of potential users, the frequency selection process and the transitional architecture are the focus of DCA/MSO studies. This report, prepared in support of the DCA/MSO Frequency Selection Working Group, assesses the technology necessary to support MILSATCOM evolution to EHF. The technology assessment delineates the present, near term (3-5 years) and far term (6-10 years) availabilities of the major MILSATCOM subsystems. The major subsystems and systemic requirements are derived from strawman systems defined by the DCA/MSO Frequency Selection Working Group. The specific subsystems assessed include low-noise receivers, RF power amplifiers and antennas for the space and ground segments. The antenna gain limitations at EHF imposed by antenna surface accuracy and tracking accuracy are also addressed. As rain attenuation at EHF impacts system design and technology requirements, a global rain attenuation model is presented and the related issues of system availability, duration and impact of rain outages, and site diversity are assessed. Finally, recommendations are presented for technology development efforts and further studies necessary to support future EHF MILSATCOM deployment. GRA

N80-11291# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
ACCURACY VALIDATION OF THE MODIFIED NIKE HERCULES RADAR
Edward M. Darcy May 1979 77 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A071720; ERADCOM/ASL-TR-0031) Avail: NTIS HC A05/MF A01 CSCL 17/9

During the week of 7-11 February 1977, 12 balloon flights were made during which the balloon was tracked simultaneously by a modified Nike Hercules radar and a range radar. The range radars used were MPS-36s. The results of these tests and the statistical results of the machine differences are presented. Results show that the Nike Hercules is quite adequate for most mesoscale applications and is also adequate as a standard of comparison for such instruments that might be developed as a replacement for the Army's GMD. GRA

N80-11292# TDR, Inc., Los Angeles, Calif.
AN INVESTIGATION OF PORTABLE ELECTROMAGNETIC PULSE SIMULATORS/ALTERNATE SIMULATORS Final Report
M. I. Sancer, S. Siegel, and A. D. Varvatsis Jun. 1979 48 p
(Contract F29601-77-C-0090)
(AD-A071342; AFWL-TR-78-200) Avail: NTIS HC A03/MF A01 CSCL 14/2

A theory is developed which defines the technical objectives for portable EMP simulator experiments and calculations. It is shown that under certain conditions, a configuration of portable sources need only excite a prescribed external interaction response on a class of systems. Under these conditions, the source configuration will excite the same electrical quantities within the system as would an EMP. Considerable attention is devoted to the demonstration that these conditions must include an accounting for the external environment to the system under test as well as the degree of electromagnetic ridigity of the portable sources. Finally, calculations that were chosen to address the plausibility of achieving the described external interaction objectives are presented and interpreted according to the required conditions. GRA

N80-11293# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
AN IMPROVED THEORY FOR MICROSTRIP ANTENNAS AND APPLICATION, PART 1 Interim Report
Y. T. Lo, W. F. Richards, and D. D. Harrison May 1979 33 p refs
(Contract F19628-78-C-0025; AF Proj. 2305)
(AD-A070791; UIEM-78-18-Pt-1; IR-1; UILU-ENG-78-2563-Pt-1; RADC-TR-79-111-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 09/5

An improvement to a recently reported theory for the analysis of the pattern and impedance loci of microstrip antennas is developed. It yields a theory which is simple and inexpensive to apply. The fields in the interior of the antennnas are characterized in terms of a discrete set of modes. The poles corresponding to these modes are complex and depend on the losses in the antenna. The representation of the fields in terms of these modes is rigorous only for a bona fide cavity with no copper loss. The proper shift in the complex poles due to the addition of copper and radiative losses is approximated by lumping the latter two together with the dielectric loss to form an effective loss tangent. By so doing, it is found that the resulting expressions for impedance of the microstrip antenna is in good agreement with measured results for all modes and feed locations. The theory is applied to the evaluation of impedance variation with feed location, multiport analysis, and to design of circularly polarized microstrip antennas. GRA

N80-11294# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
AN ANALYSIS OF THE DISK MICROSTRIP ANTENNA, PART 2 Interim Report
Y. T. Lo, D. D. Harrison, and W. F. Richards Griffiss AFB, New York RADC May 1979 98 p refs
(Contract F19682-78-C-0025)
(AD-A070794; UIEM-78-19-Pt-2; IR-2; UILU-ENG-78-2564-Pt-2; RADC-TR-79-132-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 09/5

Disk microstrip antennas are treated as cavities, from which both internal and external (radiation) field can be determined, based on an efficient improved theory. This theory can predict the impedance characteristics very accurately even for cases where the dominant mode is not strongly excited. The theory is extended to two-port disk microstrip antennas. In particular, if one port is shorted the input resonant impedance at another port on the circumference can be varied over orders of magnitude

by simply changing the relative angular positions between the two ports. In case of a single port a similar variation of input impedance can be achieved by moving the feed in the radial direction. All of these provide a means for impedance matching with practically no effect on the pattern. So far as the input impedance matching is concerned the antenna can be represented accurately by a parallel resonant circuit in series with an inductance. The former derives from the resonant mode term and the latter from all non-resonant terms of the field solution in expansion. Experiments have been conducted to verify the theoretical results. Excellent agreement is observed in all cases. GRA

N80-11295# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DEVELOPMENT OF A VOICE FUNNEL SYSTEM Quarterly Technical Report, 1 Feb. - 30 Apr. 1979
M. Hoffman and R. D. Rettberg 29 Jun. 1979 42 p
(Contract MDA903-78-C-0356; ARPA Order-3653)
(AD-A072424; BBN-4149; QTR-3) Avail: NTIS
HC A03/MF A01 CSCL 17/2

This Quarterly Technical Report covers work performed during the period noted on two projects: (1) the development of a high-speed interface, called a Voice Funnel, between digitized speech streams and a packet-switching communications network, and (2) the analysis of Pluribus performance and end-to-end flow control in the wideband satellite network. GRA

N80-11296# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DEVELOPMENT OF A VOICE FUNNEL SYSTEM Quarterly Technical Report, 1 Nov. 1978 - 31 Jan. 1979
M. Hoffman and R. T. Rettberg 14 Jun. 1979 38 p refs
(Contract MDA903-78-C-0356; ARPA Order 3653)
(AD-A072423; BBN-4143; QTR-2) Avail: NTIS
HC A03/MF A01 CSCL 17/2

This quarterly technical report covers work performed during the period noted on the development of a high-speed interface, called a Voice Funnel, between digitized speech streams and a packet-switching communications network. GRA

N80-11297# TDR, Inc., Los Angeles, Calif.
PSEUDOSYMMETRIC EIGENMODE EXPANSION FOR THE MAGNETIC FIELD INTEGRAL EQUATION AND SEM CONSEQUENCES Final Report
Maurice I. Sancer, A. D. Varvatsis, and Scott Siegel Jun. 1979 57 p refs
(Contract F29601-78-C-0098)
(AD-A071429; AFWL-TR-78-172) Avail: NTIS
HC A04/MF A01 CSCL 20/3

An eigenmode expansion for the magnetic field integral equation (MFIE) is derived which eliminates the requirement that an adjoint solution be explicitly sought. Instead, an orthogonality relation is derived which only involves the eigenmodes of the original MFIE operator. To promote confidence in the validity of the resulting expansion, two analyses based on this expansion are presented which lead to known results. First, the expansion is applied to the problem of determining the surface current density induced on a perfectly conducting sphere by a plane wave and the known solution for this problem is duplicated by the expansion. The second analysis shows that for a general perfectly conducting body, the eigenmode expansion coefficient numerator evaluated at the purely imaginary frequency corresponding to an interior resonance is zero. This result is necessary in order to relate the eigenmode expansion to SEM. GRA

N80-11298# TDR, Inc., Los Angeles, Calif.
FORMULATION OF ELECTROMAGNETIC PULSE EXTERNAL INTERACTION ABOVE A LOSSY EARTH Final Report
M. I. Sancer, S. Siegel, and A. D. Varvatsis Jun. 1979 58 p refs
(Contract F29601-77-C-0090)
(AD-A071327; AFWL-TR-78-173) Avail: NTIS
HC A04/MF A01 CSCL 20/3

Two separate but related efforts are described in this report. The first and more significant effort is a demonstration of the capability of the patch zoning method for numerically solving the magnetic field integral equation (MFIE). This is accomplished by comparing experimental data with numerical computations of the current density induced on metallic structures. The secondary effort is a derivation of the electric field integrodifferential equation (EFIDE) and the MFIE for electromagnetic pulse external interaction with perfectly conducting bodies above a finitely conducting half-space. The relationship between the two efforts is that the equations are represented in such a manner that the computational results, which are compared with experimental data, are readily seen to correspond to the numerical treatment of special cases of the MFIE finitely conducting ground equations. GRA

N80-11299# Mission Research Corp., Santa Barbara, Calif.
RADIO COMMUNICATION UTILIZING THE BASE OF A STRIATED BARIUM PLASMA
G. J. Fulks, L. D. Scott, D. H. Sowle, and W. R. Nortman Jul. 1978 43 p refs
(Contract DNA001-78-C-0237)
(AD-A072167; AD-E300465; MRC-R-401-R; DNA-4670T)
Avail: NTIS HC A03/MF A01 CSCL 17/2

In conjunction with the DNA barium releases, Avefrio I and II, an experiment was undertaken to determine if radio communication was possible off the base of a striated plasma created by these barium releases. A transmitting station was set up to broadcast a steady signal at two HF frequencies toward the base of the barium striations and two receiving stations listened for signal returns on the two frequencies. (The chosen geometry prevented reflections off the sides of the barium cloud from affecting the experiment). One station heard substantial returns while the other heard nothing. Data from the first station provide an estimate of the reflection cross sections for the base of the striated barium cloud. The negative result from the second station arises partly from limited sensitivity of equipment but the upper limit on cross section was less than that seen from the first station. This suggests a directional character for the signal reflected from the base of the cloud. GRA

N80-11300# Lincoln Lab., Mass. Inst. of Tech., Lexington.
REDUCTION OF QUANTIZATION NOISE IN PCM SPEECH CODING
Jae S. Lim and Alan V. Oppenheim 31 May 1979 21 p refs
(Contract F19628-78-C-0002; AF Proj. 649L)
(AD-A072203; TN-1979-47; ESD-TR-79-85) Avail: NTIS
HC A02/MF A01 CSCL 17/2

A new technique to reduce the effect of quantization noise in PCM speech coding is proposed. The procedure consists of using dither noise to ensure that the quantization errors can be modelled as additive signal independent noise and then reducing this noise through the use of a noise reduction system. The procedure is illustrated with examples. GRA

N80-11301# Naval Ocean Systems Center, San Diego, Calif.
TIME ENCODED SPATIAL DISPLAY. TIME-COMPRESSED DISPLAY SYSTEM USES SOLID-STATE COMPONENTS AND DATA COMPRESSION TECHNIQUES FOR IMAGE PROCESSING, STORAGE, AND RETRIEVAL Technical Document, Feb. 1978 - Feb. 1979
B. D. Directo and R. J. Morin 25 Apr. 1979 28 p
(AD-A072128; NOSC/TD-258) Avail: NTIS
HC A03/MF A01 CSCL 17/9

This report describes in detail the operation and capabilities of the TIESPAD unit. This unit was tested with AN/SPS-10 surface search radar and an AN/SPS-30 air search radar, and with an AN/FPS-93 air search radar via a microwave relay. These brief tests show that the TIESPAD unit does effectively help the operator to detect and track moving targets that would otherwise not be detected on a standard AN/SPS-type indicator. GRA

N80-11302# National Academy of Sciences - National Research Council, Washington, D. C. Panel on the Extent of Radiation from the PAVE PAWS Radar System.
ANALYSIS OF THE EXPOSURE LEVELS AND POTENTIAL BIOLOGICAL EFFECTS OF THE PAVE PAWS RADAR SYSTEM Final Report
Stephen F. Cleary (Va. Commonwealth Univ.), W. Ross Adey (Veterans Admin. Med. Center, Loma Linda, Calif.), Om P. Gandhi (Utah Univ.), Don R. Justesen (Veterans Admin. Med. Center, Kansas City, Mo.), Brockway McMillan (Bell Telephone Labs., Whippany, N.J.), Shields Warren (New Engl. Deaconess Hosp.,

Boston, Mass.), Clayton S. White (Okla. Med. Res. Found., Okla. City, Okla.), George M. Wilkening (Bell Telephone Lab, Murray Hill, N. J.), Arthur W. Guy (Wash. Univ., Seattle, Wash.), and David E. Janes (EPA, Silver Spring, Md.) 1979 106 p refs (Contract F49620-78-C-0118)
(AD-A072332; AFSC-TR-79-07) Avail: NTIS HC A06/MF A01 CSCL 17/9

The Panel on the Extent of Radiation from the PAVE PAWS Radar System was charged to examine the extent of radiation and the exposure of the public to radiation from the PAVE PAWS system. In carrying out this task, the Panel has considered the characteristics of the PAVE PAWS radiation as related to public exposure and compared the possible exposure to existing ambient radiofrequency radiation on Cape Cod and in other locations in the United States. To provide perspective for the assessment of possible exposure effects the Panel has also, to the extent possible, reviewed and summarized the state of knowledge concerning the biologic effects of exposure to such radiation. The Panel did not address the question of the desirability or adequacy of the anticipated exposure control procedures, nor did it make a judgment concerning the relative safety or hazard of exposure to PAVE PAWS emissions. GRA

N80-11303# National Academy of Sciences - National Research Council, Washington, D. C. Engineering Panel on the PAVE PAWS Radar System.
RADIATION INTENSITY OF THE PAVE PAWS RADAR SYSTEM Final Report
Brockway McMillan (Bell Telephone Labs.), Henry G. Booker (Calif. Univ., San Diego), C. Chaplin Cutler (Stanford Univ.), Om P. Gandhi (Utah Univ.), Charles Lerch (System Planning Corp.), Russell C. Newhouse, and Victor A. Vysootsky (Bell Telephone Labs.) 1979 51 p refs
(Contract F49620-78-C-0118)
(AD-A072333; AFSC-TR-79-08) Avail: NTIS HC A04/MF A01 CSCL 17/9

This volume contains the results of a panel study of the assessment of certain aspects of the PAVE PAWS radar facility in regard to radiation emissions. GRA

N80-11304# Naval Postgraduate School, Monterey, Calif.
A MODEL FOR ESTIMATING RADIOWAVE ACQUISITION RECEIVING SYSTEM INTERCEPT PROBABILITY Final Report
Jeffrey B. Knorr Jun. 1979 39 p
(AD-A072503; NPS-62-79-005) Avail: NTIS HC A03/MF A01 CSCL 15/4

This report describes a method for estimating radiowave acquisition receiving system intercept probability. Performance data for two or more receiving systems is required to implement the method. GRA

N80-11305# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ENHANCEMENT AND BANDWIDTH COMPRESSION OF NOISY SPEECH
Jae S. Lim and Alan V. Oppenheim 26 Jun. 1979 99 p refs (Contracts F19628-78-C-0002; N00014-75-C-0951; AF Proj. 7820)
(AD-A073139; TN-1979-51; ESD-TR-79-159) Avail: NTIS HC A05/MF A01 CSCL 09/4

Over the past several years there has been considerable attention focussed on the problem of enhancement and bandwidth compression of speech degraded by additive background noise. This interest is motivated by several factors including a broad set of important applications, the apparent lack of robustness in current speech compression systems and the development of several potentially promising and practical solutions. One objective of this paper is to provide an overview of the variety of techniques that have been proposed for enhancement and bandwidth compression of speech degraded by additive background noise. A second objective is to suggest a unifying framework in terms of which the relationships between these systems is more visible and which hopefully will provide a structure which will suggest fruitful directions for further research. GRA

N80-11306# Naval Research Lab., Washington, D. C.
SPECTRAL ESTIMATES OF BAND-LIMITED SIGNALS Interim Report
William B. Gordon 2 Aug. 1979 22 p refs
(RR0210541)
(AD-A072776; NRL-8322) Avail: NTIS HC A02/MF A01 CSCL 09/4

We consider the problem of estimating the spectrum of a band-limited signal perturbed by additive white noise. Sharp bounds on the mean square errors of linear spectral estimates are computed and expressed as functions of time-bandwidth product sand signal-to-noise power ratios. When the data are sampled at the Nyquist rate, no linear spectral estimator can produce significantly more accurate results than the conventional discrete Fourier transform. In the more general case, consistent spectral estimators can be obtained only if both the data rate and the length of the observation window are increased without bound. GRA

N80-11307# Naval Research Lab., Washington, D. C.
A MULTIPLE-BEAM MICROWAVE ANTENNA BASED ON THE PRINCIPLE OF THE MILLS CROSS Progress Report
J. F. Siebert, L. R. Murphy, T. R. Larson, and J. P. Hollinger 3 Apr. 1979 57 p refs
(AD-A072876; AD-E000309; NRL-MR-3959) Avail: NTIS HC A04/MF A01 CSCL 09/5

A study has been carried out to determine the feasibility of various antenna configurations for a proposed satellite mission to profile the surface temperature of the ocean using a passive microwave radiometer. Specifically, a static, multiple-beam microwave antenna utilizing a phase-switched Mills cross as its basic element is proposed and analyzed in detail. Although the Mills cross configuration does not completely meet the specified requirements of this particular application, its analysis does provide a necessary frame of reference for assessing its usefulness in general, and for establishing its features and drawbacks relative to alternative antenna configurations. It also serves as an illustrative example of some of the design tradeoffs and problems that are encountered in trying to map the earth's surface from a space platform. GRA

N80-11308# Virginia Polytechnic Inst. and State Univ., Blacksburg. Human Factors Lab.
RASTER-SCAN DISPLAY PHOTOMETRIC NOISE MEASUREMENT Final Technical Report, Aug. 1975 - Dec. 1977
Harry L. Snyder, Maier Almagor, and David I. Shedivy Wright-Patterson AFB AMRL Jun. 1979 70 p refs
(Contract F33615-76-C-5022; AF Proj. 7184)
(AD-A073024; VPI-HFL-79-1; AMRL-TR-79-13) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes the results of two studies designed to measure dynamic noise, photometrically, on a raster-scan display. One study evaluated spot microphotometry of a single raster line; the other evaluated microdensitometric power spectral analysis of close-up photographs of raster lines. The spot microphotometry technique proved superior and very reliable, yielding results that are highly correlated with input noise spectra. GRA

N80-11309# Rome Air Development Center, Griffiss AFB, N.Y.
HEMISPHERICAL COVERAGE OF FOUR-FACED AIRCRAFT ARRAYS
Robert J. Mailloux and William G. Mavroides May 1979 19 p refs
(AF Proj. 4600)
(AD-A073079; RADC-TR-79-176) Avail: NTIS HC A02/MF A01 CSCL 17/1

This report describes the radiating characteristics of a four-faced array with faces arranged in a streamlined configuration for hemispherical coverage. The report presents new experimental and theoretical results giving coverage for a side array in the plane perpendicular to the cylinder and shows that the structure radiates both polarizations efficiently for angles from the zenith to the horizon. In the absence of mutual coupling effects, the circularly polarized radiation remains within approximately 1 dB of the array projection factor. Finally, the report presents coverage contours for a four-faced array with the front and back faces half the size of the side faces. In this case, the proper choice of front array tilt angle can result in a hemispherical gain projection

factor within 3.5 dB of peak gain over nearly the whole hemisphere. GRA

N80-11310# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
SPACE-TIME SIGNAL PROCESSING OF RADAR RETURNS Technical Report, Dec. 1977 - Oct. 1978 on Phase 2
G. R. Cooper and C. D. McGillem Griffiss AFB, N.Y. RADC Jun. 1979 58 p refs
(Contract F30602-75-C-0082; AF Proj. 9567)
(AD-A072751; RADC-TR-79-156) Avail: NTIS HC A04/MF A01 CSCL 17/9

This work shows the presence of spatial symmetries which may allow a radar system to predict a frequency which will give a near maximum response as the target approaches the radar. If the target is complex then the target may be resolved into simpler components, which have desirable characteristics, and symmetries that may be exploited when tracking the target. An efficient method for the approximate evaluation of the time ambiguity functions for complex pulse envelope shapes has also been presented. GRA

N80-11311# Sandia Labs., Albuquerque, N. Mex.
LONG-TERM INSTABILITY PROBLEMS IN ADAPTIVE NOISE-CANCELERS
N. Ahmed (Kansas State Univ.), G. R. Elliot, and S. D. Stearns Aug. 1978 25 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1032) Avail: NTIS HC A02/MF A01

The performance of the nonrecursive adaptive noise canceler (or predictor) is considered in terms of long term stability. The concept 'error-surface' is introduced and how a predictor can have a distributed error surface is described. Also, how its transfer function can wander from narrowband to broadband due to small perturbations at the input is discussed. Solutions to this instability problem are proposed. These include the MLMS algorithm and a perturbation scheme. Both solutions are shown to work successfully in a simple example and are implemented in a field usable microprocessor band filter. J.M.S.

N80-11312# California Univ., Livermore. Lawrence Livermore Lab.
PROPAGATION OF Lg WAVES ACROSS EASTERN EUROPE AND ASIA
A. J. Piwinskii and D. L. Springer 19 Jul. 1978 103 p refs
(Contract W-7405-eng-48)
(UCRL-52494) Avail: NTIS HC A06/MF A01

Data regrarding Lg propagation across Asia and eastern Europe is reported. The data from earthquakes located within the boundaries of the U.S.S.R. indicate that both short and long period Lg waves propagate efficiently across most of the Soviet Union land mass. The data from certain border regions, however, display erratic characteristics that may be due to propagation, source depth, or radiation pattern. These regions include paths across southern portions of the Black and Caspian Seas, the Caucasus Mountains, the Uzbek and Tadzhik Republics, the Sea of Okhotsk, and the northern seas (e.g., the Kara Sea). The only areas that appear to block Lg propagation completely are the central portions of the Sea of Japan and regions of the People's Republic of China. DOE

N80-11313# Standard Elektrik Lorenz A.G., Stuttgart (West Germany). Unternehmensgruppe Nachrichtentechnik.
CONCEPT FOR A WORLDWIDE CIVIL MARITIME SATELLITE COMMUNICATION NETWORK (MARSAT). OPERATION SYSTEM STUDY Final Report
Oskar Bettinger, Heinz Cohrs, Johannes Conradt, Kurt Lindig, Rudolf Mosch, Eberhard Mueller, Gotteried Porst, Dieter Roth, and Kurt Taenzer Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 216 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1073; GfW-01-E-0724)
(BMFT-FB-W-77-13) Avail: NTIS HC A10/MF A01; ZLDI, Munich DM 45.15

A concept for a worlwide maritime satellite communication network that can fulfill the requirement of long-term demand and still allow further was worked out. At least three, maximally six geostationary satellites having linear transponders will each make full use of the exclusive MARSAT frequency. Best suited modulation methods and optimization procedures are discussed for normal and reduced requirements. Each satellite, its shore terminals, and the ships within its coverage area combine their functions to a single explored automatic local exchange. It is interfaced to existing telephone and telex networks. Procedures for optimum use of satellite channels are described. Central signaling channels are proposed for all call data, coordination, and remote control of channel selection on ships. The need for special distress call channels is justified. Author (ESA)

N80-11314# Standard Elektrik Lorenz A.G., Stuttgart (West Germany). Unternehmensgruppe Nachrichtentechnik.
PARABOLIC ANTENNA FOR HOME RECEIVERS OF THE BROADCASTING SATELLITE SYSTEM Final Report
Ruediger Zeitz Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1978 32 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-5007; DFVLR-BPT-01-YX-046)
(BMFT-FB-W-78-13) Avail: NTIS HC A03/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggeinstein-Leopoldshafen, West Ger. DM 6.60

The planned broadcasting satellite system, operating within the 12 GHz band, requires small, inexpensive parabolic antennas. An antenna having high gain and small sidelobes was developed in order to show the feasibility of the mentioned system. In experiments, a parametric amplifier as well as a mixer were directly connected to the antenna. The antenna design enables the operator to direct the antenna towards the satellite (azimuth, elevation) and to parallel the polarization. It is shown that this simple design can be regarded as a prototype for an antenna to be mass produced. Author (ESA)

N80-11315# Uppsala Univ. (Sweden). Inst. of Technology.
SOME METHODS FOR IDENTIFICATION OF LINEAR SYSTEMS WITH NOISY INPUT OUTPUT DATA
Torsten Soederstroem Sep. 1978 39 p refs
(UPTEC-78-73-R) Avail: NTIS HC A03/MF A01

Most identification methods rely on the assumption that the input is known exactly. However, when collecting data under an identification experiment it may not be possible to avoid noise in measuring the input signal. Some different ways to identify systems from noisy data are discussed. Sufficient conditions for identifiability are given. An approach which treats the measured input and output signals as outputs of a multivariable stochastic system is presented. If a prediction error method is applied using this approach the system will be identifiable under mild conditions. Such conditions are given. Author (ESA)

N80-11316# Fondazione Ugo Bordoni, Rome (Italy).
CONSIDERATIONS ON PROJECTS FOR HIGH CAPACITY AND LONG DISTANCE NUMERICAL DATA TRANSMISSION SYSTEMS [CONSIDERAZIONI INERENTI AL PROGETTO DI SISTEMI NUMERICI DI TRASMISSIONE A ELEVATA CAPACITA' E A GRANDE DISTANZA]
Odoardo Brugia, Benedetto Daino, Giancarlo DeMarchis, Domenico Deseta, Gabriele Falciasecca, Wolfango Maggi, Claudio Rossi, and William Wolfowicz Oct. 1977 14 p refs In ITALIAN Presented at 25th Intern. Congr. on Commun., Genoa, Oct. 1977
(FUB-50-1977) Avail: NTIS HC A02/MF A01

Some problems concerned with digital multiplexing of 140 Mbit/sec plesiochronous tributaries and transmission of the multiplexed signals over coaxial cables, optical fibers, or circular waveguides are investigated. Frame formats and frame alignment strategy characteristics are designed for three different systems having four, five, or six tributaries and operating at 560.488, 700.672, or 840.768 Mbit/sec, respectively. Orientative results are given for designing the repeater section of these systems for both the cases of coaxial cable and optical fiber transmission. Finally, the main characteristics of two waveguide systems operating at about 560 and 840 Mbit/sec are outlined on the basic of technical and economical considerations. Author (ESA)

N80-11317# Fondazione Ugo Bordoni, Rome (Italy).
THE RELATIONSHIP BETWEEN DISTORTION AND IMAGE QUALITY: SAMPLING PROCEDURES AND ACCURACY
Salvatore Miceli and Antonino Orlando Sep. 1977 7 p refs Presented at Intern. Symp. on Meas. in Telecommun., Lannion, France, Oct. 1977

(FUB-51-1977) Avail: NTIS HC A02/MF A01

The time variability in subjective assessments of image quality is considered as well as its effect on the evaluation of the mean opinion in double stratified samples of observers viewing still images. Attention is focused on a sampling procedure which avoids the factors that might introduce a bias in the function used in the least squares fit of experimental data. A method to evaluate the accuracy of the fitted function and to verify the validity of the additional law of impairments is also presented. Author (ESA)

N80-11318# Fondazione Ugo Bordoni, Rome (Italy).
SELF-PHASE MODULATION AND TRANSMISSION IN OPTICAL FIBERS
Bruno Crosignani and Paolo DiPorto Dec. 1978 9 p refs
(FUB-23-1978) Avail: NTIS HC A02/MF A01

The self-modulation effects in fibers and the role of linear dispersion are described, pointing out that while self-phase modulation can significantly broaden the spectrum of a pulse propagating over a long fiber length, the same mechanism allows, under certain circumstances, the transmission of short pulses without distortion. The investigation of nonlinear propagation in a single-mode fiber, taking advantage of the formalism of couple-mode equations, is proposed in order to contribute to the study of the transmission of stable solitary pulses. Author (ESA)

N80-11319# Fondazione Ugo Bordoni, Rome (Italy).
CHARACTERIZATION OF WAVE SCATTERING FROM RAINFALL, WITH PARTICULAR REFERENCE TO THE POSSIBLE INTERFERENCE IN EARTH-SATELLITE-EARTH LINKS AT FREQUENCIES ABOVE 10 GHz [CARATTERIZZAZIONE DELLA DIFFUSIONE DA IDROMETEORE CON PARTICOLARE RIGAURDO ALLE POSSIBILI INTERFERENZE TRA COLLEGAMENTI TERRESTRI E VIA SATELLITE A FREQUENCE SUPERIORI A 10 GHz]
Aldo Paraboni (Milan Polytec.) Nov. 1978 67 p refs In ITALIAN
(FUB-26-1978) Avail: NTIS HC A04/MF A01

Wave scattering due to rainfall is discussed in consideration of electromagnetic scattering from raindrops with rotational symmetry. It is shown that the Mie or Oguchi algorithms must be adapted to obtain a description that makes possible the integration of the effects of all the raindrops that constitute a dispersion. Then, the integration of dispersion scattering along with the characteristics of the resultant radiation. Scatter coupling and the evaluation of the received power and wave polarization are covered. Finally, details of application to the SIRIO-FUB station link are given, determining the insertion loss matrix and the polarization loss (1.45 dB for only one antenna oriented along the major axis of the polarization ellipse). Author (ESA)

N80-11320# Fondazione Ugo Bordoni, Rome (Italy).
RADIO COMMUNICATIONS AT EXTREMELY HIGH FREQUENCIES: THE USE OF METEOROLOGICAL DATA [RADIOCOMUNICAZIONI A FREQUENZE ELEVATISSME. UNA NOVA UTENZA DEI DATI IDROMETEOROLOGICI]
Francesco Barbaliscia, Francesco Fedi, and Bruno Peroni (Rome Univ.) Sep. 1978 17 p refs In ITALIAN Presented at CNR Convegno sull'Aggior delle Metodologie di Raccolta ed Elaborazione dei Dati Idrometeorol., Rome, Nov. 29-30, 1978
(FUB-27-1978) Avail: NTIS HC A02/MF A01

Extensive hydrometeorological measurements were conducted in relation to microwave propagation. The time distribution function of rain intensity in the microwave path was conducted. The relationship between attenuation and rain intensity was studied at 10, 11, and 30 GHz using 50 rain gages during several years and data were measured with high time-resolution. The systematic rain intensity data was recorded in selected spots. It is concluded that results obtained from available methods are in general acceptable, and that the integration time is an important measurement parameter. Counting the number of discharges of normal rain gages on a five minutes time-base and then extrapolating from distribution curves for smaller periods is recommended. Author (ESA)

N80-11321# Fondazione Ugo Bordoni, Rome (Italy).
PRECIPITATION AND MULTIPATH EFFECTS ON PROPAGATION PHENOMENA. SYSTEM CHARACTERISTICS AND TRANSMISSION QUALITY OF NUMERICAL RADIO LINKS WITH AND WITHOUT FREQUENCY REUSE [INFLUENZA DEI FENOMENI PROPAGATIVI DOVUTI A PRECIPITAZIONE E CAMMINI MULTIPLI. E DELLE CARATTERISTICHE DEL SISTEMA SULLA QUALITA' DI TRASMIZZIONE DI PONTI RADIO NUMERICI CON E SENZA RIUSO DI FREQUENZE]
Paolo Mandarini (Rome Univ.) Dec. 1978 65 p refs In ITALIAN
(FUB-29-1978) Avail: NTIS HC A04/MF A01

A general system description and a simulation program are presented. The system description includes channel models and design check-up for both the case where it is possible not to consider the effect of band selectivity due to echoes and where it is. The simulation program blocks description includes source simulation, codifiers, mathematical pulse sequence generators, modulators, channels, filters, and demodulators. Numerical results are given for a pure quaternary phase shift keying system, with rectangular base band pulses, six pole Butterworth emitting filters, and four pole Butterworth receiving filters. The margin reduction in the presence of an echo is calculated for the cases with and without reuse of frequency. It is concluded that the reuse of intersticial type channel frequencies is in general more convenient than use of channels at the same frequency (1.4 dB against 2.3 dB for non-selective propagation conditions). Author (ESA)

N80-11322# Fondazione Ugo Bordoni, Rome (Italy).
ELECTROMAGNETIC WAVE PROPAGATION THROUGH RANDOMLY ORIENTATED NONSPHERICAL PARTICLES. A GENERAL THEORY [PROPAGAZIONE DI ONDE E.M. ATTRAVERSO DISPERSONI DI PARTICELLE NONSFERICHE CON ORIENTAMENTO CASUALE. UNA TEORIA GENERALE]
Carlo Capsoni (Politec. di Milan), Francesco Fedi, Dario Maggiori (Politec. di Milan), and Aldo Paraboni Oct. 1978 30 p refs In ITALIAN
(FUB-31-1978) Avail: NTIS HC A03/MF A01

The depolarization effects found when electromagnetic waves propagate through randomly dispersed nonspherical particles are analyzed. Numerical results are presented for the case of centimeter waves propagation through a medium of ellipsoidal raindrops. Particular orientations of the raindrops are considered. It is concluded that a simplified model that assumes that all drops have the same orientation is sufficient to describe the propagation of 30 GHz waves. Curves of differential phase-differential attenuation-polarization for 11 and 30 GHz are given. Author (ESA)

N80-11323# Fondazione Ugo Bordoni, Rome (Italy).
A PROPOSAL FOR A NONLINEAR METHOD OF REPRESENTATION OF VOICE SIGNALS [PROPOSTA PER UN NUOVO METODO NON LINEARE DI RAPPRESENTAZIONE DEI SEGNALI VOCALI]
Lucio Prina Dec. 1978 28 p refs In ITALIAN
(FUB-33-1978) Avail: NTIS HC A03/MF A01

Mathematical models of the audio signal transformation in the human ear are discussed pointing out the limitations of linear models, and a nonlinear bispectral anelysis is proposed. The Kernel method of fixing the shape of the integral equations that determine the transformation is reviewed, concluding that the bispectral analyzer model of the human ear is the simpler hypothesis when considering nonlinear systems. A program for calculating bispectral acoustic signals was written in order to examine the validity of this model. Author (ESA)

N80-11324# Fondazione Ugo Bordoni, Rome (Italy).
THE RHYMED WORDS METHOD OF MEASURING THE INTELLIGIBILITY INDEX IN AUDIOMETRIC WORK. THE INFLUENCE OF OPEN AND CLOSED VOWELS [METODO DELLE PAROLE RIMATE PER LA MISURA DELL'INDICE DI INTELLIGIBILATA' PER SCOPI AUDIOMETRICI. INFLUENZA DELLE VOCALI APERTE E CHIUSE]
Foster Bianchi Feb. 1979 11 p In ITALIAN
(FUB-1-1979) Avail: NTIS HC A02/MF A01

The influence of open and closed vowels (o and e) in the Italian language intelligibility rhyme tests was examined. The test material consisted of 15 lists of 25 four letter words grouped

in five sets with a difference in the initial consonant within each set. The magnetic recording of this phonetic material was carried out together with a second recording of a disturbance signal whose intensity could be independently controlled. The experimental design and the results are discussed, showing that no significant difference between intelligibility indexes are found between open and closed vowel words and that some of the lists present average indexes which are significantly different from the mean due to statistical coincidences of signal and masking noise, thus requiring a time-displacement of the masking noise recording for its use in future experiments. Author (ESA)

N80-11325# Research Inst. of National Defence, Linkoeping (Sweden).
RADIO-WAVE PROPAGATION INVESTIGATIONS ON A DIGITAL RADIO LINK AT 2.2 GHz
Aake Blomquist, Folke Eklund, and Sture Wickerts Mar. 1979 64 p refs In SWEDISH; ENGLISH summary
(FOA-A-30020-E2) Avail: NTIS HC A04/MF A01

Propagation measurements comprising recordings of field strength, bit error rates, and spectral characteristics of fading were carried out on two paths 73 km and 49 km long respectively, in the same geographical area. The paths were running over rugged forested terrain in the middle of Sweden. A 34 Mbit/sec signal was transmitted using four phase shift keying. Conventional fading statistics were evaluated. Results show that the quality of the received digital data flow deteriorates at much smaller fading depths than expected at simple flat fading. The dominant reason for fading is radio wave reflection or refraction in horizontal layers in the lowest few hundred meters of the atmosphere where there are significant changes in the radio refractive index. A possible physical description of these fading events is presented. Author (ESA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-11326*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USE OF GLOW DISCHARGE IN FLUIDIZED BEDS Patent Application
Theodore Wydeven, Peter C. Wood (San Jose State Univ. Foundation, Calif.), E. Vernon Ballou (San Jose State Univ. Foundation, Calif.), and Leroy A. Spitze, inventors (to NASA) (San Jose State Univ., Calif.) Filed 26 Oct. 1979 15 p
(NASA-Case-ARC-11245-1; US-Patent-Appl-SN-088663) Avail: NTIS HC A02/MF A01 CSCL 09C

Static charges and agglomeration of particles in a fluidized bed system are minimized by maintaining in at least part of the bed a radio frequency glow discharge. This approach is eminently suitable for processes in which the conventional charge removing agents, i.e., moisture or conductive particle coatings, cannot be used. The technique is applied here to the disproportionation of calcium peroxide diperoxyhydrate to yield calcium superoxide, an exceptionally water and heat sensitive reaction. NASA

N80-11327*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT PIPE COOLING OF POWER PROCESSING MAGNETICS
Irving G. Hansen and Morris Chester (TRW Corp., Redondo Beach, Calif.) 1979 10 p refs Presented at the 14th Intern. Conf. on Elec. Propulsion, Princeton, N. J., 30 Oct. - 2 Nov. 1979; Sponsored by AIAA and Deut. Ges. fur Luft- und Raumfahrt
(NASA-TM-79270; E-223) Avail: NTIS HC A02/MF A01 CSCL 09C

A heat pipe cooled transformer and input filter were developed for the 2.4 kW beam supply of a 30 cm ion thruster system. This development yielded a mass reduction of 40% (1.76 kg) and lower mean winding temperature (20 C lower). While these improvements are significant, preliminary designs predict even greater benefits to be realized at higher power. The design details are presented along with the results of thermal vacuum operation and the component performance in a 3 kW breadboard power processor. R.E.S.

N80-11328*# Hughes Research Labs., Malibu, Calif.
SOLID-STATE X-BAND COMBINER STUDY Final Report
O. Pitzalis, Jr. and K. J. Russell Aug. 1979 79 p refs Prepared for JPL
(Contracts NAS7-100; JPL-955223)
(NASA-CR-162432) Avail: NTIS HC A05/MF A01 CSCL 09C

The feasibility of developing solid-state amplifiers at 4 and 10 GHz for application in spacecraft altimeters was studied. Bipolar-transistor, field-effect-transistor, and Impatt-diode amplifier designs based on 1980 solid-state technology are investigated. Several output power levels of the pulsed, low-duty-factor amplifiers are considered at each frequency. Proposed transistor and diode amplifier designs are illustrated in block diagrams. Projections of size, weight, and primary power requirements are given for each design. R.C.T.

N80-11329# Syracuse Univ., N. Y. Dept. of Mechanical and Aerospace Engineering.
RECTANGULAR FLAT-PACK LIDS UNDER EXTERNAL PRESSURE IMPROVED FORMULAS FOR SCREENING AND DESIGN, REVISED Final Report
Charles Libove Jun. 1979 87 p refs
(Contract F30602-78-C-0083; AF Proj. 2306)
(AD-A072421; MAE-1233-T1; RADC-TR-79-138) Avail: NTIS HC A05/MF A01 CSCL 09/5

Earlier work is improved and extended to provide formulas for the maximum tensile stress in the lid-to-wall seal, the maximum lid deflection, and the lid collapsing pressure for a rectangular flat-pack under external pressure. It is shown how these formulas can facilitate (a) the proper design of the package so that it will retain its hermeticity and serviceability under a given screening pressure and (b) the selection of a proper pressure to use in the hermeticity screening of an already designed package. Information is also given on the approximate equivalence of external pressure and centrifuge acceleration in regard to the seal stresses and lid behavior. Finally, experimental data on package hermeticity are presented which tend to confirm the validity of the main hypotheses of the present work.
Author (GRA)

N80-11330# Northrop Corp., Des Plaines, Ill. Defense Systems Div.
I/J BAND LOW-COST CROSSED-FIELD AMPLIFIER Final Technical Report, 28 Mar. 1977 - 31 Mar. 1979
Robert R. Moats Jun. 1979 54 p refs
(Contract DAAB07-77-C-2642)
(AD-A072311; Rept-094-008972; DELET-TR-77-2642-F) Avail: NTIS HC A04/MF A01 CSCL 09/1

This program is directed toward development of an I/J band, linear format, injected-beam crossed-field amplifier (IBCFA) for electronic warfare. The IBCFA should be capable of power output of 1000 W peak, 200 W average, between 8.5 and 17 GHz with 20 dB gain. A laser-cut shaped-substrate meander line is used. Performance in an E/F band IBCFA was evaluated, for which the objective performance in the 2-4GHz band is 3.0 kW peak power output, 1.0 kW average power output, also with 20 dB gain. In addition, a gun for I/J band was designed. The technology for constructing meander circuits on laser-cut shaped substrates bonded to co-expansive ground planes has been established. Operating CFA's have been built and tested in E/F-band, and cold test meander circuits have been built in I/J-band. The first E/F-band operating CFA using the shaped-substrate meander line, and other parts common with a standard E/F-band CFA design, was built and tested. Performance was comparable with a typical CFA of standard design, slightly lower in efficiency at mid band and approximately the same over the remaining part of the 2-4 GHz band. The second E/F band operating model was limited in peak power, apparently from RF arcs for reasons not yet determined. GRA

N80-11331# Watkins-Johnson Co., Palo Alto, Calif.
HIGH AVERAGE POWER BROADBAND ELECTRON-BOMBARDED SEMICONDUCTOR EBS AMPLIFIER Monthly Progress Report, 1 Dec. 1978 - 30 Apr. 1979
Bruce Bell 30 Apr. 1979 11 p
(Contract N66001-78-C-0295)
(AD-A072533) Avail: NTIS HC A02/MF A01 CSCL 09/5

During the current reporting period the analysis phase of the program was completed, which included the diode design study, thermal analysis and output matching circuit analysis. Based on the analysis, modifications are currently being made to two existing diode mask sets. Diode fabrication will not continue until the mask sets are completed. Similarly, device fabrication will not continue until additional testing has been completed on contract no. F30602-78-C-0247, whose goal is to develop a 500 W peak, 20% duty amplifier for JTIDS in conjunction with this program. It is planned that device fabrication will resume by May, which will allow sufficient time for completion of the program on schedule. GRA

N80-11332# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ELECTRIC AND MAGNETIC FIELDS OF AN INTENSE PULSE OF RELATIVISTIC ELECTRONS PROPAGATING THROUGH AIR Final Report
Kenneth A. Dreyer 1979 206 p refs
(AD-A071621; AFIT/DS/PH/79-1) Avail: NTIS HC A10/MF A01 CSCL 20/3

Since propagation characteristics of an electron beam traversing a neutral gas are determined by the response of the beam electrons to their self-fields, an accurate evaluation of the electric and magnetic (EM) fields is essential to any propagation analysis. We report here on theoretical models that were developed for the electromagnetic fields associated with an electron beam propagating in air. One- and two-dimensional models of the fields, and a model for the electron avalanche of the air, were solved on a computer. The major conclusions from calculational results are: the ionization model adequately describes the ionization process over a pressure range of from five Torr to 760 Torr; ionization lag from the high energy secondary electrons is unimportant; in many cases, the one-dimensional model was found to be as good as the two-dimensional model; and the net current saturates near 15 kilo-Amperes at sea-level pressure, and saturates at lower values at lower air pressure. GRA

N80-11333# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
NANOSECOND PULSERS FOR MM WAVE TUBES Interim Report, Sep. 1978 - Jan. 1979
J. Stover and N. Komatsu Jul. 1979 23 p
(Contract DAAB07-78-C-2991; DA Proj. 1L1-62705-AH-94)
(AD-A071414; HAC-FR79-14-353; IR-1; Delet-TR-78-2991-1)
Avail: NTIS HC A02/MF A01 CSCL 09/5

No decision has been reached as to the semiconductor device that will be used as the switching element for the nanosecond pulsers. The evaluation of avalanche transistors, VMOS FET, and LASS devices is continuing. A contributing factor to the lack of progress during the early months of the contract was program staffing problems and late arrival of critical test equipment. GRA

N80-11334# Pennsylvania State Univ., University Park. Materials Research Lab.
CERAMIC PIEZOELECTRIC TRANSDUCERS Final Report, 1 Jan. - 31 Dec. 1978
L. E. Cross, J. V. Biggers, and R. E. Newnham 1 Jun. 1979 247 p refs
(Contract N00014-76-C-0515; DARPA Order 3203)
(AD-A071652) Avail: NTIS HC A11/MF A01 CSCL 20/2

The work described in this report was carried out in the Materials Research Laboratory of The Pennsylvania State University over the period January 1, 1978 to December 31, 1978. The period is the final year of a joint DARPA:ONR sponsored three-year contract effort directed towards the development of new and improved piezoceramic materials for electromechanical transducers. A major success of the program has been the development of new composite transducers with unusually high piezoelectric g(h) coefficients. A second important advance has been the development of a new family of electrostrictive materials based on the ferroelectric relaxor Pb3MgNb209 (PMN). Sophisticated computer aided graphics techniques have been used to develop a phenomenological Gibbs function for the PZT solid solution family. In support of these major efforts, a considerable amount of detailed work has been done to develop the processing capabilities required to assemble the many different ceramics and composites which have been the topics of study. A small additional effort was committed to the growth of single crystals and of oriented polycrystals of the ferroelectric antimony sulphur iodide. GRA

N80-11335# Boeing Aerospace Co., Seattle, Wash. Navy Systems and Advanced Projects Div.
OPTICAL POWER SPECTRUM ANALYSIS OF PROCESSED IMAGERY Final Report, 10 Jan. 1978 - 30 Jun. 1979
Richard A. Schindler Jul. 1979 80 p refs
(Contract F33615-78-C-0503; AF Proj. 2313)
(AD-A073083; AMRL-TR-79-29) Avail: NTIS HC A05/MF A01 CSCL 09/4

This report describes the approach, procedures and results of a study to examine the use of information density values based on image power spectra as tools in the selection and application of digital image processing techniques. Information density measures are determined for unprocessed and processed imagery and compared with observer target recognition performance. The report describes modifications to the information density measure to improve the relationship with performance and to select the most effective processing technique. GRA

N80-11336# Naval Research Lab., Washington, D. C.
THE EQUIVALENT CIRCUIT IN THE MOBILITY ANALOGY OF A MAGNETOSTRICTIVE TRANSDUCER IN THE PRESENCE OF EDDY CURRENTS Interim Report
Steven W. Meeks 26 Mar. 1979 42 p refs
(RR0110842)
(AD-A072879; AD-E000305; NRL-8294) Avail: NTIS HC A03/MF A01 CSCL 09/1

Recent research into the highly magnetostrictive rare earth iron compounds has renewed an interest in magnetustrictive transducers. A typical magnetostrictive transducer is designed with the aid of an equivalent circuit which electrically represents the differential equations that govern the motion of the transducer. The equivalent circuit is used to predict the transmitting responses, receiving response, electrical impedance, and efficiency of the transducer. Ohmic losses generated by eddy currents in metallic magnetostrictive transducers reduce the efficiency and alter the electrical impedance. Thus an equivalent circuit is required which can predict the effect of eddy currents on the efficiency, the electrical impedance, the transmitting responses, and the receiving response of a magnetostrictive transducer. The report presents the derivation of an equivalent circuit of a magnetostrictive transducer in the presence of eddy currents using an exact eddy-current theory. However, use of the exact theory can be time consuming. Lumped equivalent circuits are also presented which use approximations to the exact theory to simply and accurately predict the efficiency and electrical impedance of a transducer with eddy currents within a frequency range of practical interest near the clamped characteristic frequency. GRA

N80-11337# Stanford Univ., Calif.
JOINT SERVICES ELECTRONICS PROGRAM OF THE EDWARD L. GINZTON LABORATORY OF STANFORD UNIVERSITY Annual Progress Report, 1 Apr. 1978 - 31 Mar. 1979
Marvin Chodorow, B. A. Auld, M. R. Beasley, S. E. Harris, and G. S. Kino Apr. 1979 90 p refs
(Contract N00014-75-C-0632)
(AD-A072766; SU-GL-2950) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report summarizes the research progress and activity on Joint Services Electronics Program Contract N00014-75-C-0632 for the period 1 April 1978 through 31 March 1979. Specific Projects are: (1) High-T(c) Superconducting Weak-Link Josephson Junctions and Circuits (M.R. Beasley); (2) Acoustic Surface Wave Scanning of Optical Images (G.S. Kino); (3) Fiber Optic Signal Processing (H.J. Shaw); (4) Nonlinear Interactions of Acoustic Waves with Domains in Ferroic Materials (B.A. Auld);

(5) Measurements of Ultrafast Physical Phenomena (A.E. Siegman); and (6) A VUV and Soft X-ray Light Source (S.E. Harris and J.F. Young). GRA

N80-11338# Surface Technology, Inc., Princeton, N. J.
NON-NOBLE COLLOIDAL CATALYSTS Final Report, 15 May 1977 - 15 Sep. 1978
Nathan Feldstein May 1979 39 p refs
(Contract F33615-77-C-5106)
(AD-A072757; AFML-TR-78-203) Avail: NTIS HC A03/MF A01 CSCL 09/5

This investigation is concerned with the development of non-noble metal autocatalytic colloids suitable for initiating electroless copper plating of printed wiring boards (PWB's). Additionally, the processing materials and parameters are selected and adjusted so that costs are reduced and the reliability of the PWB's are increased. This is achieved by the elimination of 'precious metals' as catalysts and the maintenance of near-normal pH levels (approx. 5-10) throughout the process thereby minimizing acidic residues on the PWB's. GRA

N80-11339# Radio Corp. of America, Princeton, N. J.
LOW-LOSS CHARGE-COUPLED DEVICE Final Technical Report, 15 May 1977 - 15 Nov. 1978
W. J. Kosonocky, D. J. Sauer, C. Y. Tayag, and F. V. Shallcross
Griffiss AFB, N. Y. RADC Jun. 1979 101 p refs
(Contract F19628-77-C-0176; AF Proj. 2305)
(AD-A072989; PRRL-78-CR-57; RADC-TR-79-144) Avail: NTIS HC A06/MF A01 CSCL 09/5

Two closed-loop CCD structures, a 256-stage and a 1024-stage devices were designed, fabricated, and operated to demonstrate a low-loss mode of operation for a very long CCD delay line or a closed-loop CCD structure. The low-loss CCD concept consists of operating a CCD with each signal charge well followed by one or more trailing-bias-charge wells. Two orders of magnitude improvement in the effective transfer losses were demonstrated experimentally by periodically recombining at a signal-regeneration stage the (first-order) signal-charge transfer losses collected by the trailing bias charger with the corresponding signal-charge packets. An effective transfer loss of 2.4 x 10 to the -7th power per transfer was demonstrated. The maximum time delay has also been improved by two orders of magnitude over that of conventional CCDs by means of a new dark-current subtraction technique. The 1024 stage closed-loop low-loss CCD was also operated as a synchronous signal correlator producting an improvement in the signal-to-noise ratio of 17.5 dB as a result of 100 signal recirculations in the loop. GRA

N80-11340# Ohio State Univ., Columbus. Electroscience Lab.
A LOOP FOR TRACKING THE FREQUENCY OF A PULSED SINUSOID Interim Report
R. J. Huff and D. W. Herr Griffiss AFB, N. Y. RADC Jul. 1979 61 p refs
(Contract F30602-75-C-0061; AF Proj. 6523)
(AD-A072750; ESL-710300-4; RADC-TR-79-171) Avail: NTIS HC A04/MF A01 CSCL 09/3

The configuration and performance of a hybrid frequency tracking loop which tracks the frequency of a pulsed sinusoid are addressed in this report. A linear model of the loop is developed and an approximate expression is derived for the standard deviation of the frequency tracking error due to the presence of additive white Gaussian noise at the loop's input. Results obtained by simulating the loop on a digital computer are presented which show the extent to which loop non-linearities affect the standard deviation of the frequency tracking error, the distribution of the frequency tracking error, and the loop lock range. These results show that the loop operates with a high degree of effectiveness. GRA

N80-11341# Naval Avionics Center, Indianapolis, Ind.
DELETERIOUS EFFECT OF FUSING FLUIDS ON PRINTED WIRING BOARDS Report, 1 Dec. 1978 - 30 Apr. 1979
David O. Pond 9 May 1979 59 p
(AD-A072716; NAC-TR-2259) Avail: NTIS HC A04/MF A01 CSCL 09/5

This study identified the corrosive effects of fusing fluids and fusing fluid residues on printed wiring boards subjected to electrical stress in a humid environment at elevated temperature. The effect of varying delay times between solder fusing and cleaning of fusing fluid residues for three fusing fluids was studied. The effect of a single delay time between solder fusing and cleaning of fusing fluid residues for eight other fusing fluids was studied. Also, the protective value of a solder resist and a conformal coating was evaluated. GRA

N80-11342# Litton Systems, Inc., San Carlos, Calif. Electron Tube Div.
FEASIBILITY DEMONSTRATION OF A HIGH POWER WIDEBAND TWT WITH LOW AM/PM DISTORTION Final Report
E. G. Chaffee 26 Feb. 1979 54 p refs
(Contract N00173-77-C-0214)
(AD-A072932) Avail: NTIS HC A04/MF A01 CSCL 09/1

Loss-line stabilized tubes have been under development at Litton Industries under the supervision of the Naval Research Laboratories since 1973. Early developmental tubes demonstrated high power, wide bandwidth and efficient operation. In-band distributed loss techniques were developed to form attenuator sections to provide lower bandedge stability and to allow efficient operation at the high frequency bandedge. Stabilization problems, however, at the upper bandedge prevented operation at full design perveance. In the last tube preceding this contract, upper bandedge stability techniques were improved significantly; but, the tube exhibited in-band regenerative oscillations which prevented direct demonstration of this stability improvement. The two tubes built under this contract both demonstrated oscillation stability at design perveance and fully demonstrated the potential of loss line stabilized tubes. The design changes and the demonstration of these two tubes are discussed in this report. GRA

N80-11343# Honeywell, Inc., Golden Valley, Minn. Ceramics Center.
PRODUCTION ENGINEERING MEASURE (PEM) MANUFACTURING METHODS AND TECHNOLOGY FOR PIEZOELECTRIC TRANSFORMERS Final Report, 14 Jul. 1975 - 14 Dec. 1978
William B. Harrison 15 May 1979 192 p refs
(Contract DAAB07-76-C-0008)
(AD-A072674; HONEYWELL-47514) Avail: NTIS HC A09/MF A01 CSCL 09/1

This is the final report on Contract DAAB07-76-C-0008, which established a cost-effective production capability for manufacturing piezoelectric ceramic transformers to be used in operating 18mm night vision image intensifier tubes. The 18 mm PET production approach established by this program produced acceptable units which met all of the specifications established for this high voltage step-up transformer. A one-element packaged PET was established in place of the original two-element developmental units. This was accomplished by establishing more realistic resistive and capacitive load requirements for each of the V12 and V3 voltage outputs. All of the equipment and tooling designed and built produced satisfactory pilot production run units. The cost objectives were achieved on the individual piezoelectric elements. Higher costs were associated with attaching leads to the PET ceramic elements and packaging was more time-consuming than desired. GRA

N80-11344# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A 3 MV PULSE TRANSFORMER
G. J. Rohwein May 1979 22 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0813) Avail: NTIS HC A02/MF A01

A 3 MV transformer designed for charging high voltage pulse forming transmission lines is described. The transformer is an air core spiral strip design which incorporates ring cage shielding to control edge breakdown in the secondary winding. The physical features of the transformer are described along with its electrical characteristics and the operational results. Air core transformers are an attractive alternative to Marx generators for charging high voltage pulse forming transmission lines (PFL) such as those used with high power electron or ion beam accelerators. Some of the advantages of transformer systems include simplicity, compactness, high reliability, reasonable cost and high energy transfer efficiency. The transformer was designed to

demonstrate these features. The primary objective, however, was to establish the feasibility of multimegavolt operation. DOE

N80-11345# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
NOISE AND OPTIMIZATION OF THE dc SQUID Ph.D. Thesis
Claudia Denke Tesche Nov. 1978 110 p refs
(Contract W-7405-eng-48)
(LBL-8510) Avail: NTIS HC A06/MF A01

A lumped circuit model for the isolated dc SQUID is developed. A set of coupled nonlinear differential equations is derived for the output voltage and circulating current as functions of time. A computer algorithm is developed to compute the time averaged SQUID I-V characteristics and noise spectral densities. DOE

N80-11346# Los Alamos Scientific Lab., N. Mex.
DESIGN OF SAFE ELECTRICAL EQUIPMENT FOR RESEARCH
J. L. Rand, R. W. Leep, and W. A. Bradley Apr. 1979 59 p refs
(Contract W-7405-eng-36)
(LA-7597-MS) Avail: NTIS HC A04/MF A01

Design information needed by research personnel engaged in the construction and operation of experimental apparatus is presented with emphasis on electrical safety. Figures, charts, and tables are used to present reference data. General information on the construction and use of Marx generators and high-voltage capacitor energy storage banks is presented with emphasis on electrical safety. DOE

N80-11347# Los Alamos Scientific Lab., N. Mex.
MAGNETIC ANOMALY IN SUPERCONDUCTING TmRh4B4
J. L. Smith, C. Y. Huang, J. J. Tsou (Wichita State Univ.), and J. C. Ho (Wichita State Univ.) 1978 10 p refs Presented at the 24th Annual Conf. on Magnetism and Magnetic Materials, Cleveland, 14-17 Nov. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2701; Conf-781114-4) Avail: NTIS HC A02/MF A01

The magnetic and superconducting properties of TmRh4B4 (which becomes superconducting at 9.6 K) were investigated by means of ac and dc magnetic susceptibility and specific heat measurements. At 10.7 K, an ac susceptibility peak similar to those found in spin glasses was observed. In addition, a pronounced specific heat peak was observed at 11.4 K. The susceptibility peak is essentially unaffected by substitution of 1% Lu or Er for the Tm, but it diminishes when much larger amounts of Er are substituted. The physical origin of this anomalous peak is discussed. DOE

N80-11348# Los Alamos Scientific Lab., N. Mex.
SOME dc SUPERCONDUCTING CABLES
William E. Keller 1979 27 p refs Presented at the 1979 Workshop on Public Policy Aspects of High Capacity Electric Power Transmissions, Aspen, Colo., 14-16 May 1979
(Contract W-7405-eng-26)
(LA-UR-79-1057; Conf-790527-1) Avail: NTIS HC A03/MF A01

The general characteristics of dc superconducting cables as well as details of two specific designs, one coaxial and the other double monopolar, are discussed. The special advantages of these cables lie in the relative simplicity of construction, their extremely high operating efficiency, and their compactness when compared with other ac or dc high-capacity cables cooled by flowing fluids, either at ambient or cryogenic temperatures. These features are discussed in the context of economic, environmental, and power system considerations, including some of the possible trade-offs among conventional and superconducting ac and dc systems. DOE

N80-11349# Bendix Corp., Kansas City, Mo.
RELIABILITY OF PACKAGED BEAM-LEAD TRANSISTORS BUILT WITH DIFFERENT PRE-SEAL ASSEMBLY TECHNIQUES
J. P. Gracey Oct. 1978 36 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-1952-Rev) Avail: NTIS HC A03/MF A01

The reliability of two TO-18 packaged beam-lead transistors was studied using high temperature reverse bias and high temperature storage as accelerated aging methods. Three pre-seal assembly techniques were evaluated and compared based on reliability test results. Results were affected by the use of damaging breakdown voltage tests during part of the experiments. DOE

N80-11350# Bendix Corp., Kansas City, Mo.
HERMETIC SEALING OF HYBRID MICROCIRCUITS: INITIAL CAPABILITY DEVELOPMENT
J. H. Williams and W. A. Piper Dec. 1978 24 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-1930-Rev) Avail: NTIS HC A02/MF A01

The capability to hermetically seal hybrid microcircuits was established. Tests indicate that helium fine leak rates in the low 10 to the 8th power cu cm/s region and moisture content of less than 500 ppm are obtained with the 80 percent gold-20 percent tin solder sealing process being used. Initial production results indicate a yield of better than 90 percent for the process. DOE

N80-11351# Underground Systems, Inc., Armonk, N. Y.
PRELIMINARY DIELECTRIC STUDIES. SPIR-O-LINE CABLE FOR APPLICATION AT POWER FREQUENCIES Final Report
John S. Engelhardt 4 Dec. 1978 55 p refs
(Contract EG-77-C-01-5054)
(HCP/T5054-01) Avail: NTIS HC A04/MF A01

A unique dielectric system for both flexible and rigid power cable applications was studied. The Spir-O-line is a high powered radio frequency transmission system. The cable consists of a central conductor continuously supported by six high density polyethylene tubes inside a metal sheath, which operates as a gas insulated transmission line with either nitrogen or SF6 as the filling medium. A rough analysis of the dielectric geometry concluded that its breakdown strength might be improved over that of the open coaxial conductor configurations. A series of breakdown tests was performed on the smaller range of commercially available sizes. The results confirmed the expected behavior patterns, but did not fully explore the upper units of performance due to occasional tube separations in the samples tested. The potential voltage ratings of the larger available sizes were estimated. There is considerable flexibility in the design of the conductor due to the continuous support of the dielectric tubes. DOE

N80-11352# Sandia Labs., Albuquerque, N. Mex. Div. 2113.
CONTROLLABILITY/OBSERVABILITY ANALYSIS OF DIGITAL CIRCUITS
Lawrence H. Goldstein Nov. 1978 28 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1895) Avail: NTIS HC A03/MF A01

The testability of a digital circuit is directy related to the difficulty of controlling and observing the logical values of internal nodes from circuit inputs and outputs, respectively. A method for analyzing digital circuits in terms of six functions which characterize combinational and sequential controllability and observability is presented. DOE

N80-11353# California Univ., Berkeley. Lawrence Berkeley Lab.
ONE SHOTS AND ALTERNATIVES IN SYNCHRONOUS DIGITAL SYSTEM DESIGN
S. Hui and J. B. Meng Jan. 1979 16 p refs
(Contract W-7405-eng-48)
(LBL-8722) Avail: NTIS HC A02/MF A01

Undesirable features of monostable multivibrators (one shots) in digital integrated circuits are described and some alternatives to their use are discussed. These include flip-flops and gates, delay lines, and other methods. DOE

N80-11354# Bendix Corp., Kansas City, Mo.
ELECTRICAL COMPENSATION SYSTEM FOR PLATED-THROUGH-HOLE TESTER: MILESTONE REPORT
W. B. Abel Oct. 1978 71 p refs Revised
(Contract EY-76-C-04-0613)

(BDX-613-1943-Rev) Avail: NTIS HC A04/MF A01

A microprocessor system was developed to control the acquisition and interpretation of resistance-measurement data from plated-through holes in printed wiring boards. The system provides a direct digital display of the thickness of the copper plating on the hole walls. The complex calibration for holes having different geometries is stored in the memory of the system, and the geometry factors are input through thumbwheel switches. A special probe system makes possible the determination of an average resistance value for each test hole without moving the probe contacts in relation to the hole. DOE

N80-11355# Bendix Corp., Kansas City, Mo.

STATIC ELIMINATION WORK STATIONS Final Report

R. S. Hedges and J. L. Bellah Dec. 1978 14 p refs Revised

(Contract EY-76-C-04-0613)

(BDX-613-1953-Rev) Avail: NTIS HC A02/MF A01

Electrostatic charges, if not properly controlled, destroy or degrade certain semiconductor devices. Several techniques for controlling static charges were evaluated, using an electronic signal selector as the primary model for investigation. Air-ionizing equipment, encapsulant additives and materials, antistatic spray, and the use of X-rays were included. DOE

N80-11356# Bendix Corp., Kansas City, Mo.

LASER WELDING OF ELECTRICAL INTERCONNECTIONS

F. R. Bauer Dec. 1978 26 p refs

(Contract EY-76-C-04-0613)

(BDX-613-2022-Rev) Avail: NTIS HC A03/MF A01

Processes and equipment were developed for welding thin aluminum and copper foils using a Nd : YAG laser. It is shown that laser welding provides an alternate technique with improved quality for welding these types of electrical terminations. DOE

N80-11357# Bendix Corp., Kansas City, Mo.

EFFECTS OF GAS PLASMA ON PRINTED CIRCUIT BOARD MATERIALS

L. C. Jackson Nov. 1978 37 p refs Revised

(Contract EY-76-C-04-0613)

(BDX-613-2030-Rev) Avail: NTIS HC A03/MF A01

The project was established to define gas plasma process parameters for printed circuit board cleaning without damage to the substrate. Process parameters of gas flow, wattage, and time are defined for both oxygen and argon treatments. The surface activity changes of plastics and printed circuit board materials are described. A preliminary evaluation of the life (surface activity) of these materials after plasma treatment is presented. Swell index, contact angle, and Meseran analysis tests were used to measure process parameters, plasma life, and surface changes. DOE

N80-11358# Argonne National Lab., Ill.

DESIGN OF A TUNABLE HIGH-Q SUPERCONDUCTING NOTCH FILTER

Charles M. Falco, R. T. Kampwirth, C. S. Pang, and I. Schuller Oct. 1978 40 p refs

(Contract W-31-109-eng-38)

(ANL-78-91) Avail: NTIS HC A03/MF A01

The design of a tunable high-Q superconducting notch filter is presented. The filter is designed to be manufactured from high T/sub c/ superconductors (Nb3Sn, Ng3Ge) made by high-rate magnetron sputtering on sapphire substrates. The geometry of the various elements, holder materials for the cryostat, studies relating to the preparation of suitable high T/sub c/ materials, and the photoetching procedures for the filter elements are discussed. DOE

N80-11359# Bendix Corp., Kansas City, Mo.

AUTOMATED MONITORING OF THIN FILM CAPACITORS FOR ELECTRICAL BREAKDOWN

R. T. Horn Jan. 1979 20 p

(Contract EY-76-C-04-0613)

(BDX-613-2076-Rev) Avail: NTIS HC A02/MF A01

The automated test system sensitivity was investigated to relate electrical background noise to electrical breakdowns. DOE

N80-11360# Danish Research Center for Applied Electronics, Hoersholm.

WILL AN INCREASING NUMBER OF COMPANIES START MAKING THEIR OWN LSI-COMPONENTS? AN EVALUATION OF DEVELOPMENT TRENDS IN THE ELECTRONICS INDUSTRY [EGEN PRODUKTION AF LSI-KOMPONENTER? EN VURDERING AF, OM UDVIKLINGEN I ELEKTRONIKINDUSTRIEN VIL MEDFOERE AT STADIGT FLERE VIRKSOMHEDER ETABLERER EGEN PRODUKTION AF LSI-KOMPONENTER]

Soeren Larsen Jun. 1978 34 p refs Partly in DANISH and ENGLISH

(ECR-82) Avail: NTIS HC A03/MF A01

Low sales volume custommade LSI market trends are examined in order to assess the market development potential for Danish companies specialized in this field. Activities of the large electric materials and electronics producers in the U.S.A. and Europe, their production programs, the financial relationship between electronic activities and LSI production, the actual extent of home-used LSI, and development trends are reviewed. It is concluded that there are few indications pointing to an increase in low sales volume custom LSI components use. On the contrary microprocessors and other commercially available LSI components can be adapted to still more applications than before so that the need for custom made LSI will diminish. Author (ESA)

N80-11361# Defence Research Information Centre, Orpington (England).

DIGITAL CALCULATION OF THE COMMUTATION CHARACTERISTICS OF ARMATURE WINDINGS

Franz Maier London Dec. 1978 58 p refs Transl. into ENGLISH from Sci. Elec., v. 19, 1973 p 97-133

(DRIC-Trans-5359; BR67219) Avail: NTIS HC A04/MF A01

The process of commutation and the role of the mechanical commutator in both electric motors and generators are discussed. The principles of modern commutation theory are reviewed and equations are derived for the commutation characteristics of armature windings. Theoretical considerations include current commutation curves and fields, independent and dependent commutation, rectilinear and medially rectilinear commutation as well as general descriptions of electromagnetic fields and their interactions. Characteristic values for the commutation properties of a winding are particularly emphasized. Commutation inductances and their calculation are covered. Various winding configurations and their associated circuit elements are modeled mathematically. Finally, calculation results are applied to specific examples of commutation behavior. Author (ESA)

N80-11362# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatiale.

ANALYSIS AND DESIGN OF A PHASE LINEARIZATION SYSTEM FOR TRAVELING WAVE TUBE AMPLIFIERS [ETUDE ET REALISATION D'UN LINEARISEUR DE PHASE POUR L'AMPLIFICATEUR A TUBE A ONDE PROGRESSIVE]

Jean-Pierre Pochon Nov. 1977 216 p refs In FRENCH; ENGLISH summary

(CNES-NT-86) Avail: NTIS HC A10/MF A01

A concise theory of the operation of traveling wave tube amplifiers TWTA is presented. The tradeoff between efficiency and nonlinearity is emphasized. Distortion in transmission of a television signal caused by nonlinearities, such as AM/PM conversion, in the TWTA of a communication channel is discussed. The performance measurement of an X-band TWTA for satellite communication and the measurement of related nonlinearity is outlined. The analysis and design of a phase linearization system which considerably reduces the AM/PM conversion coefficient and so allows the TWTA to be operated at saturated power are shown. The study was conducted in the 11 GHz frequency band and applications to satellite television transmission are cited. Author (ESA)

N80-11363# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatiale.

ON THE USE OF A SEMI-AUTOMATED TEST SYSTEM FOR MEASURING THE CHARACTERISTICS AND/OR THE 'S' PARAMETERS OF A QUADRUPOLAR NETWORK [UTILISATION D'UN SYSTEME DE TEST SEMI-AUTOMATIQUE POUR LA MESURE DES CARACTERISTIQUES ET/OU DES PARAMETRES 'S' D'UN QUADRIPOLE]

Jean-Luc Sedard Nov. 1978 78 p In FRENCH; ENGLISH summary
(CNES-NT-87) Avail: NTIS HC A05/MF A01

The implementation and use of a semi-automated test system based on a Hewlett-Packard computer, type HP 9825 A, and its associated peripherals is described. The system includes a series of programs which allow the measurement of the chief characteristics of a four terminal network (quadripolar) versus input power (linearity, phase, etc.) at a constant frequency, or versus frequency (gain, bandwidth, phase, transit time, etc.) for a given input power. This allows microwave equipment performance to be checked and determined rapidly. A second series of programs was studied to obtain the S parameters characteristic of a four terminal network. It automatically calibrates the equipment and calculates, from the measurements, the real parameters, allowing for errors introduced either by the equipment or by the measurement principle. Author (ESA)

N80-11364# Toulouse Univ. (France). Lab. de Genie Electrique.

ELECTRICAL PROPERTIES OF SOLID INSULATORS AS A FUNCTION OF TEMPERATURE AND PRESSURE Final Report [PROPRIETES ELECTRIQUES DES ISOLANTS SOLIDES EN FONCTION DE LA TEMPERATURE ET DE LA PRESSION]

Jun. 1978 12 p In FRENCH
(Contract CNET-75-9B-BCF/LET)
(Publ-364) Avail: NTIS HC A02/MF A01

A high pressure (1500 bar) experimental device working in the -50C to 150C temperature range was built in order to measure the low and high frequency dielectric loss coefficient of insulating materials which are currently used in underwater telephone cables. Results related to polyethylene losses in the 0.1 to 15 MHz range show that these losses increase with pressure and frequency at a given temperature, while the permittivity diminishes at higher pressures. The experimental values present a rather large dispersion in spite of several corrections that were being considered. Author (ESA)

N80-11365# Pisa Univ. (Italy). Ist. di Elettrotecnica.

ON THE MAGNETIZING ENERGY BALANCE IN ELECTRIC NETWORKS, PARTICULARLY REGARDING NETWORKS INVOLVING MACHINES WITH COMMUTATORS [SUL BILANCIO DELL'ENERGIA MAGNETIZZANTE NELLE RETI ELETTRICHE, CON PARTICOLARE RIGUARDO ALLE RETI COMPRENDENTI MACCHINE A COMMUTAZIONE]

R. Bini and L. Taponecco 1978 11 p refs
(Rept-1630) Avail: NTIS HC A02/MF A01

The magnetizing energy balance for various types of electric networks involving machines with commutators of electronic switching devices is considered. It is assumed that the networks are nonsinusoidal in operation. Three different networks are analyzed. These are a network with a permanent magnet which is immobile, a network containing a permanent magnet which is in relative motion, and a network whose circuit is subjected to the periodic interruption and reinsertion of a magnetic field. The characteristics of the energy balance are discussed for each case. In order to establish the validity of theoretical assumptions a test circuit was built and its characteristics measured. Results show acceptable agreement. Author (ESA)

N80-11366# Uppsala Univ. (Sweden). Dept. of Electronics.

A METHOD FOR TEMPERATURE STABILIZATION OF CURRENT GENERATORS AND ZENERDIODES

Tommy Oeberg Oct. 1978 18 p ref
(UPTEC-78-76-R) Avail: NTIS HC A02/MF A01

An inexpensive method for temperature stabilization of zener diodes and current generators is presented. The method makes it possible to compute the temperature dependence of the current in a simple one transistor current generator. The temperature drift can be utilized to balance the temperature variation of the voltage over a zener diode. The method is based on differentiation of the expression for the output current generator. A formula for the calculations is presented which makes the method easy to use. Good results were obtained. Minor changes in the calculations make it possible to compute the dependence on variation in other parameters, such as in the supply voltage. Author (ESA)

N80-11367# Fondazione Ugo Bordoni, Rome (Italy).

MULTIHOLE COUPLERS BETWEEN DIFFERENT WAVEGUIDES. THEORY AND EXPERIMENTS

Franco Bertolani and Gabriele Falciasacca (Bologna Univ.) Aug. 1978 6 p refs Presented at 6th Colloq. on Microwave Commun., Budapest, Aug. 1978
(FUB-30-1978) Avail: NTIS HC A02/MF A01

A procedure to obtain, with the required approximation, the phase shift in multihole couplers between equal or different waveguides is presented in order to avoid the problem of experimental adjustment when a strong coupling is wanted. The experimental results show good agreement with theory. This design method was extensively used to produce couplers between the TE1C of rectangular waveguides and the more important modes of circular waveguides (TE01, TE02, TE11, TE12, TM11). In the described example for a coupler with the TE01 mode a 0.5 dB coupling was obtained at the design frequency (30 to 38 GHz band). Author (ESA)

N80-11368# AEG-Telefunken, Berlin (West Germany). Forschunginst.

UNCONVENTIONAL CIRCUITS FOR STATIC VOLTAGE TRANSFORMERS Final Report

Johannes Nestler, Guenther Junge, Ingeborg Tzivelekas, and Hans Wrede Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 269 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-78-26) Avail: NTIS HC A12/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 56.90

The design and development of circuits for static converters are reported on. These include primarily thyristor/transistor circuits as well as a circuit for load-controlled converters. In thyristor/transistor circuits transistors are used for quenching and commutation purposes as well as to protect thyristors. With these circuits the rated current can be commuted down to very low input voltages. The load-controlled converter by virtue of this method of commutation is characterized by simple design and by the fact that it displays high efficiency at high clock frequencies. Two load-controlled converters were constructed, one of which provided a power of 20 kW at a clock frequency of 7 kHz, the efficiency achieved being 90%. Modular systems were developed for voltage converters. In this connection the possible application of heat pipes was examined for such converters with respect to the dependence on mounting position and the start-up and peak load behavior. Author (ESA)

N80-11369# Royal Aircraft Establishment, Farnborough (England). Defensive Weapons Dept.

A SIMPLE PULSE PEAK DETECTOR

G. A. Wilkinson London Sep. 1977 16 p refs
(RAE-TM-DW-10; BR60614) Avail: NTIS HC A02/MF A01

A simple peak detector was built to act as an analog monitor of the height of a video pulse train such as might be received from a pulsed microwave transmitter. The performance of the circuit as a function of pulse width and pulse repetition frequency (PRF) was investigated. The detector is shown to be usable for pulse widths greater than 1 micro sec and PRF's greater than about 50 Hz. Author (ESA)

N80-11370# Danish Research Center for Applied Electronics, Hoersholm.

A COMPARATIVE 5000 HOURS LIFE TEST OF LIGHT EMITTING DIODE DISPLAYS, INCLUDING 22 VARIANTS FROM 10 MANUFACTURERS

H. J. Nordby Mar. 1979 48 p Sponsored by Dan. Council of Technol. and Soc. for Reliability and Environ. Testing (SPM) Original contains color illustrations
(ECR-86) Avail: NTIS HC A03/MF A01

Each type of display was represented in 4 groups. The 4 groups were exposed in different environments with different load conditions. None of the displays were overloaded with respect to the manufacturers specifications. During the 5000 hours life test the total 7 segment luminous intensity from each display was measured and recorded. In this way is is possible to produce degradation curves for each variant. The intensity of all segments in one group was recorded to determine the nonuniformity for each display. The results show that only a few variants display

remarkable degradation. Temperature cycling and intermittent operation are the only exposures that produce catastrophic failures. The nonuniformity is found to be a serious drawback for a number of the investigated devices. Author (ESA)

N80-11371# National Bureau of Standards, Washington, D. C. Electron Devices Div.

SEMICONDUCTOR TECHNOLOGY PROGRAM, PROGRESS BRIEFS Interim Report, Jan. - Mar. 1979

W. Murray Bullis, ed. Jun. 1979 12 p refs Sponsored in part by Div. of Elec. Energy Systems, Defense Nucl. Agency, Wash., D. C., Charles Stark Draper Lab., Inc., Cambridge, Mass., AFAL, Wright-Patterson AFB, Ohio, Army Electronics R/D Command, Ft. Monmouth, N. J.

(Contracts N00030-78-C-0100; EX-77-A-01-6010; ARPA Order 2897)

(PB-298064/7; NBSIR-79-1591-3) Avail: NTIS HC A02/MF A01 CSCL 09A

The current status of work on measurement technology for semiconductor materials, process control, and devices is presented. Highlighted activities include studies of reverse-bias second breakdown, an integrated gated-diode electrometer, random fault measurements, pattern generator positional accuracy, intrachip linewidth variation, transient upset in TTL circuits, photoresist sensitometry, optical linewidth measurements, spreading resistance profiling, model spreading resistance data, silicon resistivity SRMs, and sheet resistance measurements. GRA

N80-11372# National Bureau of Standards, Washington, D. C. Electron Devices Div.

SEMICONDUCTOR TECHNOLOGY PROGRAM, PROGRESS BRIEFS Interim Report, Oct. - Dec. 1978

W. Murray Bullis Mar. 1979 12 p refs Sponsored in part by Div. of Elec. Energy Systems, Defense Nucl. Agency, Wash., D. C., Charles Stark Draper Lab., Inc., Cambridge, Mass., AFAL, Wright-Patterson AFB, Ohio and Army Electronics R/D Command, Ft. Monmouth, N. J.

(Contract N00030-78-C0100; EX-77-A-01-6010; ARPA Order 2397)

(PB-298063/9; NBSIR-79-1591-2) Avail: NTIS HC A02/MF A01 CSCL 09A

The current status of work on measurement technology for semiconductor materials, process control, and devices is presented. Highlighted activities include studies of process-induced radiation damage, resistivity-dopant density relationships in silicon, spreading resistance measurements, spreading resistance profiling, cross-bridge sheet resistor test structure, PIND test, moisture infusion into hermetic packages, and conduct of a workshop on power semiconductor devices. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N80-11373# Missouri Univ. -Rolla. Dept. of Chemistry.

TRANSPORT PROPERTIES FOR ABLATION PRODUCTS: AN ILLUSTRATION USING THE He-C2H INTERACTION

Louis Biolsi 2 Oct. 1979 33 p refs Backup document for AIAA synoptic 'Proposed computational method for transport properties of ablation products' scheduled for publication in AIAA journal in Apr. 1980

Avail: NTIS HC A03/MF A01

The peripheral force method for obtaining atom-molecule interaction potentials was applied to the He-C2H interaction (C2H is an important ablation product and He is one of the primary species in the Jovian atmosphere). Results indicate that the peripheral force method can be applied to the calculation of transport properties for interactions involving other ablation products. R.C.T.

N80-11374# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.

FLOW BEHIND CURVED SHOCK WAVES

S. Molder Sep. 1979 43 p refs

(Grant AF-AFOSR-3303-77)

(UTIAS-217; ISSN-0082-5255) Avail: NTIS HC A03/MF A01

Equations are presented for the gradients of pressure, density and velocity behind curved shock waves in a uniform upstream flow. Formulas are given for the inclination of constant property lines behind two dimensional, conical and doubly curved shocks. Graphical results are presented for lambda = 1.4 and a free stream Mach number of 3.0. An equation is derived which relates the inclination of the isobars, isopycnics and isotachs. A general relationship is derived for doubly curved shocks which connects the two shock curvatures and the streamline curvature just behind the shock wave. Curved shock theory is applied to the calculation of flow curvature and pressure gradients in the vicinity of a normal shock as well as to finding the orientation of the sonic line behind a curved oblique shock in uniform flow. Author

N80-11375*# Old Dominion Univ. Research Foundation, Norfolk, Va.

EFFECTS OF PRECURSOR HEATING ON RADIATIVE AND CHEMICALLY REACTING VISCOUS FLOW AROUND A JOVIAN ENTRY BODY Final Report, 1 Feb. 1978 - 31 Mar. 1979

S. N. Tiwari and K. Y. Szema Washington NASA Oct. 1979 183 p refs

(Grant NsG-1492)

(NASA-CR-3186) Avail: NTIS HC A09/MF A01 CSCL 20D

The influence of change in the precursor region flow properties on the entire shock layer flow phenomena around a Jovian entry body was investigated. The flow in the shock layer was assumed to be steady, axisymmetric, and viscous. Both the chemical equilibrium and the nonequilibrium composition of the shock layer gas were considered. The effects of transitional range behavior were included in the analysis of high altitude entry conditions. Realistic thermophysical and radiation models were used, and results were obtained by employing the implicit finite difference technique in the shock layer and an iterative procedure for the entire shock layer precursor zone. Results obtained for a 45 degree angle hyperboloid blunt body entering Jupiter's atmosphere at zero angle of attack indicates that preheating the gas significantly increases the static pressure and temperature ahead of the shock for entry velocities exceeding 38 km/sec. The nonequilibrium radiative heating rate to the body is found to be significantly higher than the corresponding equilibrium heating. The precursor heating generally increases the radiative and convective heating of a body. That increase is slightly higher for the nonequilibrium conditions. R.C.T.

N80-11376*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STREAKLINE FLOW VISUALIZATION STUDY OF A HORSESHOE VORTEX IN A LARGE-SCALE, TWO-DIMENSIONAL TURBINE STATOR CASCADE

Raymond E. Gaugler and Louis M. Russell 1979 20 p refs Proposed for presentation at 25th Intern. Gas Turbine Conf. and Products Show, New Orleans, La., 9-13 Mar. 1980; sponsored by ASME

(NASA-TM-79274; E-201) Avail: NTIS HC A02/MF A01 CSCL 20D

Neutrally bouyant helium-filled bubbles were observed as they followed the streamlines in a horseshoe vortex system around the vane leading edge in a large scale, two dimensional, turbine stator cascade. Inlet Reynolds number, based on true chord, ranged between 100,000 to 300,000. Bubbles were introduced into the endwall boundary layer through a slot upstream of the vane leading edge. The paths of the bubbles were recorded photographically as streaklines on 16 mm movie film. Individual frames from the film were selected, and overlayed to show the details of the horseshoe vortex around the leading edge. The transport of the vortex across the passage near the leading edge is clearly seen when compared to the streaks formed by bubbles carried in the main stream. Limiting streamlines on the endwall surface were traced by the flow of oil drops. Author

N80-11377*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RADIATIVE AND FREE CONVECTIVE HEAT TRANSFER FROM A CONTAINERLESS SPHERE
Karen Johnson Sep. 1979 29 p refs
(NASA-TM-78249) Avail: NTIS HC A03/MF A01 CSCL 20D

A mathematical model is derived for heat loss due to radiation and free convection for a small copper sphere (approximately 0.3 to 0.4 cm diameter) cooled by a helium-argon gas mixture. A FORTRAN program written to simplify calculations and extend the range of applicability to experimentation is presented. Pressures used were less than 400 torr, and resulting temperatures ranged from 500 to 4600 K. Comparison of results for initial cooling by the gas mixture with experimental data showed a 5 percent error for temperature values and a 2.7 percent error for the temperature difference caused by the cooling. Results indicate that the accuracy could be increased significantly by using better estimates for thermal conductivities. R.C.T.

N80-11378# Tel-Aviv Univ. (Israel). School of Engineering.
FURTHER OBSERVATIONS ON TRANSITION IN A PIPE Interim Report, Mar. 1978 - Mar. 1979
Y. Rubin, I. Wygnanski, and J. H. Haritonidis Jun. 1979 43 p refs
(Contract AF AFOSR-3275-77; AF Proj. 2307)
(AD-A071909; AFOSR-79-0869TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Fully developed Poiseuille flow in a pipe was artificially disturbed at x/D = 400 and 17-RE-4000. Puffs and slugs generated by the disturbance were identical to the structures observed when the flow in the inlet region had undergone transition (Wygnanski and Champagne 1973). Since the disturbance was sufficiently strong to cause transition even at low Reynolds numbers the appearance of either puffs or slugs depended on the Reynolds number only. Velocity measurements in the pipe were taken with rakes of hot wires using digital acquisition methods and in this way each realization could be observed in its entirety. The coherence of the large structures was studied in radial and azimuthal directions. Puffs and slugs generated by the disturbance were mapped and found to be identical to the structures observed at the inlet region of the pipe. It was established that a slug which has all the attributes of a fully developed turbulent pipe flow is generated by a coalescence of puffs. The puff, which seems to contain a small number of toroidal eddies appears to be a fundamental coherent structure in a fully developed turbulent pipe flow. Previous observations, which were based on a single-point measurement and ensemble-averaged data did not reveal the full structure of the puff in the same detail as the present techniques. Single realizations were analyzed showing instantaneous velocity profiles, vorticity perturbation contours, as well as streamlines moving with the structure. Artificially generated successions of puffs which were allowed to interact, closely resembled a slug. The evolution of a slug from puffs was thus established. GRA

N80-11379# TriTec, Inc., Columbia, Md.
DEVELOPMENT OF CRITICAL FLUIDIC COMPONENTS
Kevin C. Chen and Vincent F. Neradka 14 Jul. 1978 79 p refs
(Contract DAAG39-77-C-0173)
(AD-A071650; HDL-CR-78-173-1) Avail: NTIS HC A05/MF A01 CSCL 13/7

This report is an independent assessment of the performance of three fluidic rate sensors which were provided for test. All tests were run using MIL-H-5606 hydraulic fluid. The results of the testing showed that the Fluidisc had the lowest threshold and null sensitivity, and that its output is sufficient to directly drive some hydraulic components. On the other hand the Laminar Angular Rate Sensor is the most economical sensor and its low noise and power consumption makes it the sensor having the most potential for future applications. GRA

N80-11380# Dynamics Technology, Inc., Torrance, Calif.
GENERATION RATE OF TURBULENT PATCHES IN THE LAMINAR BOUNDARY LAYER OF A SUBMERSIBLE
C. P. Chen, Y. Goland, and E. Reshotko Jun. 1979 56 p refs
(Contract N00014-77-C-0005)
(AD-A071796; DT-7902-9) Avail: NTIS HC A04/MF A01 CSCL 20/4

Suspended particulate in the environment of underwater vehicles has been suspected to be responsible for the generation of turbulent patches in the laminar boundary layer of the vehicle. This speculation, which is supported by much indirect evidence, is examined in this report through an attempt at calculating the turbulent patch generation rate. The method presented herein is based on the premise that patches are generated by those particles entering the boundary layer that are sufficiently large to 'trigger' a turbulent event. Since the triggering mechanism is not known, the choice of a critical particle size will involve some empiricism. An important element of the method is the calculation of the number of particles of a given size and specific gravity that enter the laminar boundary layer, through computation of the particle trajectories in the inviscid flow field about the vehicle. GRA

N80-11381# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
NUMERICAL SOLUTION OF RECIRCULATING FLOW BY A SIMPLE FINITE ELEMENT RECURSION RELATION
D. W. Pepper and R. E. Cooper 1979 27 p refs Presented at the 2d Intern. Conf. on Computational Methods in Nonlinear Mech., Austin, Tex., 26-30 Mar. 1979
(Contracts EY-76-C-09-0001)
(DP-MS-78-83; Conf-790311-4) Avail: NTIS HC A03/MF A01

A time-split finite element recursion relation, based on linear basis functions, is used to solve the two-dimensional equations of motion. Recirculating flow in a rectangular cavity and free convective flow in an enclosed container are analyzed. The relation has the advantages of finite element accuracy and finite difference speed and simplicity. Incorporating dissipation parameters in the functionals decreases numerical dispersion and improves phase lag. DOE

N80-11382# Knolls Atomic Power Lab., Schenectady, N. Y.
NUMERICAL SOLUTION OF TURBULENT FLOW PROBLEMS IN GENERAL GEOMETRY
E. L. Wachspress Mar. 1979 24 p refs Presented at Conf. on Appl. of Numerical Analysis, Dundee, UK, 26 Jun. 1979
(Contract EY-76-C-12-0052)
(KAPL-4116; Conf-790620-1) Avail: NTIS HC A02/MF A01

Turbulent flow of fluid was computed satisfactorily with the TEACH program for a wide spectrum of problems. The TEACH geometry is restricted to rectangular grids in Cartesian or cylindrical coordinates. The TURF program uses the TEACH methodology with foursided isoparametric elements. This broadens modeling capabilities and enhances practical utilization of the TEACH method. It was discovered that a thorough understanding of TEACH numerics was essential for the desired geometry generalization. Crucial aspects of the analysis arise in study of the Navier-Stokes momentum and continuity equations without the complications associated with turbulence modeling common to TEACH and TURF. Among the devices in TEACH are direct computation of primitive variables, interlocking velocity and pressure grids, and derivation of pressure equations from integration over boxes of the continuity equation in which pressures do not appear explicitly. DOE

N80-11383# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF IMPLICIT NUMERICAL METHODS TO PROBLEMS IN TWO-PHASE FLOW
John H. Mahaffy and D. R. Liles Apr. 1979 15 p refs
(Contract W-7405-eng-36)
(NUREG-CR-0763; LA-7770-MS) Avail: NTIS HC A03/MF A01

A numerical method for treating two-phase flow in pipes is presented which incorporates the use of a partially implicit scheme in regions of relatively low flow velocity and a fully implicit treatment in regions of high velocity. This method takes advantage of the lower cost per iteration of the partially implicit scheme, without being limited by its conditional stability. Applications of this approach to water reactor blowdown calculations produce reductions in computer time by factors of 2-4 without a significant loss of accuracy. DOE

N80-11384# Bendix Corp., Kansas City, Mo.
COOLING ALUMINUM MOLDS USING HEAT PIPES Final Report
D. R. Hahn Dec. 1978 49 p ref Revised
(Contract EY-76-C-04-0613)
(BDX-613-2039-Rev) Avail: NTIS HC A03/MF A01

A system was developed to provide zone cooling and more efficient heat removal from an aluminum mold used to make a polyurethane foam part. Heat removal with heat pipes and forced convection was four to six times faster than cooling without heat pipes in still air. Tests are planned to determine if zone cooling will reduce shrinkage depressions in parts fabricated in this mold. DOE

N80-11385# Sandia Labs., Albuquerque, N. Mex. Computational Physics and Mechanics Div.
COUPLEFLO: A COMPUTER PROGRAM FOR COUPLED CREEPING VISCOUS FLOW AND CONDUCTIVE-CONVECTIVE HEAT TRANSFER. PART 2: USER'S MANUAL
P. F. Chavez and P. R. Dawson Nov. 1978 72 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1407) Avail: NTIS HC A04/MF A01

A user manual for a two dimensional finite element code (COUPLEFLO) for plane strain or axisymmetric analyses of thermomechanically coupled systems is presented. It is capable of analyzing the creeping flow of non-Newtonian fluids or the secondary creep of solids. The program solves equations for conductive-convective heat transfer to determine the thermal response of a system. Thermomechanical coupling between the flow field and temperature distribution can exist in terms of temperature dependent material properties, temperature dependent body forces, viscous dissipation, material convection, and changing system geometry. Either transient or steady-state problems can be analyzed in Eulerian or quasi-Lagrangian reference frames. The governing equation, finite element formation, and verification of code capabilities are presented with the instructions for use. DOE

N80-11386# California Univ., Livermore. Lawrence Livermore Lab.
TWO-DIMENSIONAL TRANSIENT DISPERSION AND ADSORPTION IN POROUS MEDIA
R. V. Homsy 23 Apr. 1979 11 p refs Presented at 5th Underground Coal Conversion Symp., Alexandria, Va., 18 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-81970; Conf-790630) Avail: NTIS HC A02/MF A01

Contaminant transport model was made of an underground aquifer following in situ coal gasification to determine the environmental impact on ground water. The aquifer was treated as a semi-infinite porous medium, bounded on top and bottom by impermeable parallel walls. Line, plane and finite-volume sources were studied. The two-dimensional convective-dispersion equation, which governs the rate of contaminant transport, was reduced to an ordinary differential equation and solved for an instantaneous source. Asymptotic series solutions valid for short and long times are given for a continuous-line source. DOE

N80-11387# Idaho National Engineering Lab., Idaho Falls.
HEAT TRANSFER CORRELATION DEVELOPMENT AND ASSESSMENT: A SUMMARY AND ASSESSMENT OF RETURN TO NUCLEATE BOILING PHENOMENA DURING BLOWDOWN TESTS CONDUCTED AT THE IDAHO NATIONAL ENGINEERING LABORATORY (INEL)
A. M. Eaton and E. L. Tolman Apr. 1979 80 p refs
(Contract EY-76-C-07-1570)
(CDAP-TR-054) Avail: NTIS HC A05/MF A01

The data are presented which were obtained in Loss-of-Coolant Experiments (LOCE) which demonstrate the presence of cladding rewetting after the critical heat flux has been exceeded as a viable cooling mechanism during the blowdown phase of a LOCE. A brief review of the mechanisms associated with the boiling crisis and rewetting is also provided. The relevance of LOCE rewetting data to nuclear reactor licensing Evaluation Model Requirements is considered, and the conclusion is made that the elimination of rewetting and return to nucleate boiling in evaluation models represents a definite conservatism. DOE

N80-11388# California Univ., Berkeley.
GAS FLOW THROUGH POROUS BARRIERS M.S. Thesis
N. S. Jacobson Oct. 1978 29 p refs
(Contract W-7405-eng-48)
(LBL-8283) Avail: NTIS HC A03/MF A01

The possibility of CO2 surface diffusion through the porous BaO that results from BaCO3 decomposition is examined. CO2 and He flow rates through a BaO barrier are compared and both are found to exhibit similar behavior. Because He is known not to undergo surface diffusion, it is concluded that CO2 goes through BaO by ordinary Knudsen flow. The decomposition of SO3 to SO2 and O2 in a porous alumina barrier is studied. The goal is to determine if this reaction will equilibrate in the barrier. A stream of SO3 is run through the barrier and the exit gas compositions are determined as a function of temperature with a mass spectrometer. These compositions are found to differ considerably from the calculated equilibrium values, indicating the reaction does not equilibrate in the barrier. DOE

N80-11389# Sandia Labs., Albuquerque, N. Mex.
TEST PLAN FOR INTERMEDIATE RANGE AIRBLAST PROPAGATION MEASUREMENTS
J. W. Reed Dec. 1978 37 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1703) Avail: NTIS HC A03/MF A01

An explosion test program is planned for firings at Cape Canaveral, Florida and Vandenberg Air Force Base, California to determine how atmospheric refraction influences explosion wave propagation. Meteorological data for correlation with airblast propagation results will be obtained from rawinsonde balloon ascensions and meteorological tower instruments. Blast pressure gages will be operated at distances of 200 m to 5 km in a cruciform array centered on the explosion area. This will allow evaluation of wind component effects in four directions from each explosion. The primary experimental goal is to correlate the airblast over-pressure distance decay rate and the sound velocity-altitude gradient in the atmospheric boundary layer. In addition, there will be exploration of: (1) wind effects on height-of-burst Mach stem formation; (2) the influences of low level winds and ground surface temperature on propagation; and (3) the attenuation caused by atmospheric turbulence. DOE

N80-11390# Sandia Labs., Albuquerque, N. Mex.
COUPLEFLO: A COMPUTER CODE FOR COUPLED CREEPING VISCOUS FLOW AND CONDUCTIVE-CONVECTIVE HEAT TRANSFER. PART 1: THEORETICAL BACKGROUND
P. R. Dawson Nov. 1978 67 p refs
(Contract EX-76-C-04-0789)
(SAND-78-1046-Pt-1) Avail: NTIS HC A04/MF A01

COUPLEFLO, a two-dimensional finite-element code for plane strain or axisymmetric analyses of thermomechanically coupled systems, is presented. It is capable of analyzing the creep flow on non-Newtonian fluids or the secondary creep of solids. COUPLEFLO solves equations for conductive-convective heat transfer to determine the thermal response of a system. Thermomechanical coupling between the flow field and temperature distribution can exist in terms of temperature-dependent materials properties, temperature-dependent body forces, viscous dissipation, material convection, and changing system geometry. Either transient or steady-state problems can be analyzed in Eulerian or quasi-Lagrangian reference frames. Governing equations, finite-element formulation, and verification of the code capabilities are presented as well as a user's manual which contains instructions for code use. DOE

N80-11391# Illinois Univ., Urbana. Dept. of Computer Science.
RUNGE-KATTA STARTERS FOR MULTISTEP METHODS
C. W. Gear Sep. 1978 36 p refs
(Contract EY-76-S-02-2383)
(COO-2383-0053; UILU-ENG-78-1733; UIUCDCS-R-78-938) Avail: NTIS HC A03/MF A01

Runge-Kutta type formulas are presented which enable a multistep method to start or restart at a high order after just one RK step. These problems with frequent discontinuities or sudden large increases in derivatives, either of which causes an automatic program to reduce order and step size suddenly. DOE

N80-11392# Energy, Inc., Idaho Falls, Idaho.
COMPARISONS OF RETRAN AND TWO-VELOCITY TWO-PHASE FLOW MODELS WITH EXPERIMENTAL DATA
Interim Report
E. D. Hughes and R. K. Fujita Nov. 1978 341 p refs Prepared for EPRI
(EPRI Proj. 958-1)
(EPRI-NP-928) Avail: NTIS HC A15/MF A01

Several aspects of two-phase flow models and computer programs associated with steady-state and transient analyses of nuclear steam supply systems were investigated. The areas investigated include: comparisons of homogeneous equilibrium mixture and two-fluid model predictions with experimental data and with each other; numerical solution techniques; comparison of RETRAN predictions with experimental data; application of RETRAN to simple multi-dimensional flows; and derivation of macroscopic balance equations for two-fluid models of two-phase flows. The results of the investigations show the accuracy and ease of application of RETRAN, some of the limitations associated with homogeneous equilibrium mixture models of two-phase flow, and some of the areas in which RETRAN can be improved. DOE

N80-11393# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
THE EFFECT OF SHORT REGIONS OF HIGH SURFACE CURVATURE ON TURBULENT BOUNDARY LAYERS
A. J. Smits, S. T. B. Young, and P. Bradshaw Dec. 1978 130 p refs Supersedes IC-Aero-TN-78-104 Submitted for publication
(Contracts AT/2037/0101; AT/2037/0141)
(IC-Aero-78-02) Avail: NTIS HC A07/MF A01

Measurements 'downstream' of 20 deg and 30 deg convex and concave bends with radii of curvature 5 to 10 times the boundary layer thickness are described. Analysis shows that relaxation downstream of the concave bends is non-monotonic; this can be explained without invoking structural changes but in fact large changes in second and third order structure parameters do occur. Author (ESA)

N80-11394# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
THE RESPONSE OF A TURBULENT BOUNDARY LAYER TO LATERAL DIVERGENCE
A. J. Smits, J. A. Eaton, and P. Bradshaw Dec. 1978 77 p refs Supersedes IC-Aero-TN-78-106 Submitted for publication
(IC-Aero-78-03) Avail: NTIS HC A05/MF A01

Measurements in the axial flow over a cylinder-flare body of flare semi-angle 20 deg, the radius of longitudinal curvature of the transition piece between the cylinder and the conical flare being about 10 times the boundary layer thickness, are described. Analysis shows that the effects of this curvature die out so that the changes in second and third-order structural parameters found in the boundary layer on the flare can be attributed to lateral divergence. The destablizing effect of a given lateral strain rate is nearly the same as the effect of longitudinal curvature. Author (ESA)

N80-11395# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
TURBULENT BOUNDARY LAYERS ON SURFACES OF MILD LONGITUDINAL CURVATURE
P. H. Hoffmann and P. Bradshaw Dec. 1978 57 p refs Sponsored in part by Brown Boveri and Co., Baden, West Ger. Submitted for publication
(Contract AT/2037/0171)
(IC-Aero-78-04) Avail: NTIS HC A04/MF A01

Detailed measurements were made on a rig in which boundary layers that have developed on flat surfaces enter a curved section with concave and convex wall radii about 100 times the initial boundary layer thickness. The data include second, third, and fourth-order mean products of velocity fluctuations and provide a consistent picture of the effects of curvature on structure parameters. Analysis shows that in general these structure parameters increase on the concave (destablized) side and decrease on the convex side, but some interesting nonmonitonic trends occur. This nonlinearity is analogous to that found in buoyant flows. Author (ESA)

N80-11396# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE EFFECT OF PRESSURE GRADIENT AND EXTERNAL TURBULENCE ON HEAT TRANSFER TO A COLD FLAT PLATE
H. Consigny, C. K. Chan, and B. E. Richards Feb. 1979 58 p refs
(VKI-TN-128) Avail: NTIS HC A04/MF A01

Measurements of heat transfer to a cold surface at conditions simulating advanced aircraft gas turbine flow conditions are presented. They obtained under isothermal wall conditions in a short duration isentropic light piston tunnel using surface temperature transient techniques. The effects of external turbulence and strong favorable pressure gradient were especially studied. Results indicate that turbulence has little or no influence on the heat transfer in a turbulent boundary layer. However, turbulence level effects the heat transfer in a laminar boundary layer both with and without pressure gradient. Measurements were also compared with various viable predictive methods including simple correlations and finite difference approaches. Poor agreement was obtained between turbulent data and predictions selected for study (approximate integral, mixing length and one equation models). Author (ESA)

N80-11397# Montpellier Univ. (France). Lab. de Physique Mathematique.
ALMOST PERIODIC N-SOLITON SOLUTIONS OF THE NONLINEAR HYDRODYNAMIC KAUP EQUATION [SOLUTIONS PRESQUE PERIODIQUES ET A N-SOLITONS DE L'EQUATION HYDRODYNAMIQUE NONLINEAIRE DE KAUP]
V. B. Matveev and M. I. Yavor (Nord-West Politech. Inst., Leningrad) 1979 22 p refs In FRENCH; ENGLISH summary
(PM/79/10) Avail: NTIS HC A02/MF A01

The algebraic geometrical integration of some hydrodynamic equations is discussed. The vast class of almost periodical solutions containing N-soliton solutions as a degenerate case is found exactly. The asymptotic behavior of N-soliton solutions is calculated at the explicit isomorphism between the Kaup equation and the complexified nonlinear Schroedinger equation is obtained. Author (ESA)

N80-11398# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). General and Environmental Fluid Dynamics Dept.
A METHOD FOR THE MEASUREMENT OF MIXING PROPERTIES IN A TURBULENT JET FLOW
C. Borrego and D. Olivari Jun. 1979 32 p refs Sponsored in part by Avieiro Univ., Portugal
(VKI-TN-130) Avail: NTIS HC A03/MF A01

An experimental investigation of the flow development of a turbulent air jet of circular cross section exhausting into still air was carried out in order to test a method for measuring certain parameters relevant to the mixing process. The measurement method involves laser equipment in combination with the introduction of a tracer in the jet in the form of oil smoke. The flow field was examined at locations varying from two to twenty diameters downstream of the nozzle. A laser doppler velocimeter and a laser scatter system were used to measure flow velocity and tracer concentration. Main parameters recorded at each downstream station were mean axial velocity, mean concentration, fluctuating velocity and concentration, and velocity-concentration correlation. Results show that the method permits an accurate description of the nozzle fluid concentration and velocity fields for a round turbulent free jet. Measurements are in general agreement with data from other sources. Author (ESA)

N80-11399# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
A STUDY OF COHERENT STRUCTURES IN AXISYMMETRIC JETS USING AN OPTICAL TECHNIQUE
Gautam T. Kalghatgi Jun. 1979 38 p refs
(Contract MIN-DEF/AT/2040/084)
(AASU-341) Avail: NTIS HC A03/MF A01

Coherent structures in the first six diameters of five axisymmetric jets of different velocities and densities were studied by an optical method using the deflection of laser beams caused by density gradients in the flow. Results show that the average

interval between succesive events increases with axial distance independently of the density, velocity, or Reynolds number of the jets and that near the nozzle exit plane the interval is very similar to that found for two dimensional mixing layers. The proposition that there are random interactions between the coherent structures as they are convected downstream is used to explain many of the observations. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-11400*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SMALL CONDUCTIVE PARTICLE SENSOR Patent Application
Israel Taback, inventor (to NASA) (Bionetics Corp., Hampton, Va.) Filed 28 Aug. 1979 14 p Sponsored by NASA
(NASA-Case-LAR-12552-1; US-Patent-Appl-SN-070366) Avail: NTIS HC A02/MF A01 CSCL 14B

This invention is an electrostatic conductive fiber detector for use in detecting, counting and measuring the length of fibers down to 0.1 mm and below with increased accuracy and reliability over prior art devices. It can be used for detection of fibers suspending in a flowing gas, in a nonflowing gas, or in a vacuum and its accumulated counts over a period of time is essentially unaffected by velocity of the fibers being detected. NASA

N80-11401# Navy Experimental Diving Unit, Panama City, Fla.
EVALUATION OF COMMERCIALLY AVAILABLE SUBMERSIBLE PRESSURE GAUGES
James R. Middleton Mar. 1979 25 p
(AD-A071481; NEDU-3-79) Avail: NTIS HC A03/MF A01 CSCL 14/2

Fourteen commercially available submersible pressure gauges were evaluated by the Navy Experimental Diving Unit to determine accuracy and watertight integrity. The gauges tested represent a realistic survey of the market. While not every gauge currently sold in the U.S.A. was tested, the results of this test are felt to represent the general state-of-the-art in gauge design and manufacturing technique. As a result of unmanned testing, and due to the overall quality of design and construction, it is recommended that submersible pressure gauges be designated as open purchase items on the list of equipment Approved for Navy Use (ANU). It should be emphasized to all divers that submersible pressure gauges should be given the same care as that given other life supporting equipment. GRA

N80-11402# Idaho National Engineering Lab., Idaho Falls.
CURRENT CAPABILITIES OF TRANSIENT TWO-PHASE FLOW INSTRUMENTS
C. W. Solbrig and N. N. Kondic (NRC) 1979 10 p refs Presented at 25th ISA Intern. Instrumentation Symp., Anaheim, Calif., 7 May 1979
(Contract EY-76-C-07-1570)
(CONF-790505-9) Avail: NTIS HC A02/MF A01

The measurement of two phase flow phenomena in transient conditions representative of a loss of Coolant Accident is presented. The geometries in which these measurements must be made, the instruments which are currently used, new instruments being developed, the facilities used to calibrate these instruments, and the improvements which must be made to measurement capabilities are described. DOE

N80-11403# Sandia Labs., Albuquerque, N. Mex.
QUARTZ RESONATOR PRESSURE GAUGE: DESIGN AND FABRICATION TECHNOLOGY
Errol P. EerNisse Jan. 1979 41 p refs
(Contract EY-76-C-04-0789)
(SAND-78-2264) Avail: NTIS HC A03/MF A01

The base technology used in designing and fabricating the Sandia Quartz Resonator Pressure Gauges for geothermal well logging is presented. The following topics are treated: resonator design (crystallographic orientation), transducer design (static stress analysis and transfer function), electrode technology, and assembly details. In addition, preliminary results of pressure measurements at 275 C are presented. DOE

N80-11404# Los Alamos Scientific Lab., N. Mex.
PREPROCESSING OF PHERMEX FLASH RADIOGRAPHIC IMAGES WITH HAAR AND ADAPTIVE FILTERING
J. E. Brolley Nov. 1978 9 p refs
(Contract W-7405-eng-36)
(LA-7561-MS) Avail: NTIS HC A02/MF A01

Haar filtering was found to be useful in developing line or edge structures along with Widrow LMS adaptive filtering. Shadow effects were obtained with the adaptive filtering technique. Application of Haar and adaptive filtering to a PHERMEX image is demonstrated. J.M.S.

N80-11405# Tennessee Univ., Knoxville.
SOLUTION MICROCALORIMETER FOR MEASURING HEATS OF SOLUTION OF RADIOACTIVE ELEMENTS AND COMPOUNDS Ph.D. Thesis
D. L. Raschella Dec. 1978 95 p refs
(Contract W-7405-eng-26)
(ORO-4447-081) Avail: NTIS HC A05/MF A01

An isoperibol, solution microcalorimeter capable of measuring the heats of solution of submilligram quantities of radioactive elements and compounds was constructed. The calorimeter was tested by measuring heats of solution of TRIS and magnesium metals. The heat of solution of curium-248 metal was then measured in I N HCl at 298 K. The experiments yielded a heat of solution of -606.4 + or - 1.8 kJ/mol. A single measurement in 6 N HCl gave a heat of solution of -602.3 kJ/mol. From these results the heat of formation of Cm/sub (aq) is calculated to be -607.2 + or - 2.5 kJ/mol. K.L.

N80-11406# Oak Ridge National Lab., Tenn.
USE OF INDEXED SENSITIVITY FACTORS IN THE ANALYSIS OF NICKEL AND IRON BASED ALLOYS: STUDY OF THE DECALIBRATION OF SHEATHED CHROMEL/ALUMEL THERMOCOUPLES
W. H. Christie 1978 7 p refs Presented at the US-Japan Seminar on SIMS, Osaka, 23 Oct. 1978
(Contract W-7405-eng-26)
(CONF-781076-1) Avail: NTIS HC A02/MF A01

Sheathed Chromel versus Alumel thermocouples decalibrate when exposed to temperatures in excess of 1100 C. Thermocouples sheathed in Inconel-600 and type 304 stainless steel were studied. Quantified SIMS data showed that the observed decalibrations were due to significant alterations that took place in the Chromel and Alumel thermoelements. The amount of alteration was different for each thermocouple and was influenced by the particular sheath material used in the thermocouple construction. Relative sensitivity factors, indexed by a matrix ion species ratio, were used to quantify SIMS data for three nickel-based alloys, Chromel, Alumel, and Inconel-600, and an ion-based alloy, type 304 stainless steel. Oxygen pressure > 2 x 10 to the 6th power torr in the sputtering region gave enhanced sensitivity and superior quantitative results as compared to data obtained at instrumental residual pressure. DOE

N80-11407# Sandia Labs., Albuquerque, N. Mex.
DESIGN OF A HIGH PRECISION DILATOMETER USING LASER INTERFEROMETRY
W. D. Drotning Dec. 1978 29 p refs
(Contract EX-76-C-04-0789)
(SAND-78-1796) Avail: NTIS HC A03/MF A01

The dilatometer described is being designed for operation from ambient to 800 C using samples which require minimal preparation. Several interferometric techniques useful to dilatometry were reviewed from the literature. As a result of this review and establishment of performance criteria, a technical design is proposed. The optical design incorporates a two-frequency He-Ne laser with ac detection in a modified Michelson interferometer. A vertical sample/furnace configuration appears

to offer a number of design advantages. Operational considerations and dilatometer development costs are also presented. DOE

N80-11408# California Univ., Livermore. Lawrence Livermore Lab.
SPECIAL SESSION ON STREAK CAMERA DYNAMIC RANGE MEASUREMENT DEFINITION
S. W. Thomas Aug. 1978 5 p Presented at 13th Congr. on High-Speed Photography and Photonics, Tokyo, 20 Aug. 1978
(Contract W-7405-eng-48)
(UCRL-81704; Conf-780804-12) Avail: NTIS HC A02/MF A01

An agreed-upon dynamic range measurement definition for use by commercial manufacturers of electro-optic streak cameras is presented and is as follows: the ratio of the peak amplitudes of an upper and lower usable signal. The limits of usable signals are to be the points at which the pulse width at half maximum is broadened or changed by 20% as referenced to the width of a pulse near the middle of the dynamic range. DOE

N80-11409# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
CONCEPT AND FEASIBILITY STUDY ON A VERY WIDE ANGLE PHOTOGRAPHIC CAMERA FOR SPACELAB Final Report
Rainer Krieger, Stephan Koschade, Ursula Kriete, Peter Vits, and Peter Henneberg Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 173 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1075; DFVLR-BPT-01-QV-595-V22)
(BMFT-FB-W-77-17) Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 36,10

With a ground version of a wide angle camera, proper images of large scale galactic structures were obtained within the range 2000 to 20,000 A. For SPACELAB applications, a similar instrument can be developed with increased spectral range to 900 A. For this purpose basic analysis was necessary regarding the optics and the detector system. Furthermore, investigations on filters, reflecting surfaces, and spectral shifters as well as on mechanical problems and compatibility with SPACELAB were necessary to establish and select feasible concepts. The increased spectral range turned out to be feasible only by mirror optics. A promising alternative to photographic film is the microchannel plate-detector still under development. Problems remain regarding sensitivity between 900 and 1100 A, but results do not rule out a possible solution. Author (ESA)

N80-11410# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
A SPECTROMETER FOR DETECTING CHARGED PARTICLES OF MEDIUM ENERGIES: EXPERIMENT KED-ISEE Final Report
Erhard Keppler, Berend Wilken, Gerhard Umlauft, Harald Fischer, Donald Williams, Klaus Richter, Erich Bubla, and Klaus Fischer Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 233 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRK-0274; DFVLR-BPT-01-DO-274)
(BMFT-FB-W-78-19) Avail: NTIS HC A11/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 48,75

A charged particle spectrometer is presented for measuring electron energies in the energy range 20 keV to 1000 keV and proton and ion energies in the energy range 25 keV to 3000 keV with high time and directional resolution. The spectrometer is on the ISEE-B satellite. The sensor system is described along with data formation and operational modes. Author (ESA)

N80-11411# Central Electricity Generating Board, Berkeley (England). Nuclear Lab.
AN ABRADING SYSTEM FOR THE MEASUREMENT OF OXIDE THICKNESS
R. Wilson, inventor Jan. 1979 4 p
(TDB-319) Avail: NTIS HC A02/MF A01

A device for the measurement of oxide or other coating thicknesses is described. The device was designed primarily for the remote measurement of oxide thickness inside a shutdown nuclear reactor. The oxide is removed over a region 1 mm in diameter by an air jet containing a controlled amount of abrasive powder. A high precision linear displacement transducer is used to measure the oxide thickness at this position. The technique is suitable for thickness in the range 10 to 2500 micron. An accuracy of + or - 5 micron is attainable. Author (ESA)

N80-11412# Central Electricity Generating Board, Heysham (England). Power Station.
IMPROVEMENTS IN APPARATUS FOR pH MEASUREMENT OF WATER
I. R. Claxton, inventor Feb. 1979 6 p
(TDB-320) Avail: NTIS HC A02/MF A01

An electronic device which automatically corrects the measurement of the pH of ammonia dosed power station boiler feedwater for changes in alkalinity brought about by the temperature dependence of the association of ammonia is described. It is noted that the pH depends on the temperature of the sample and that in a typical boiler plant where pH may be measured at the extraction pump, deaerator, and economizer inlet, widely varying values of pH may be indicated. The pH at the temperature of the sample is corrected to a standard temperature of 25 C. Author (ESA)

N80-11413# Fulmer Research Inst. Ltd., Stoke Poges (England).
SPACE DOSIMETRY. VOLUME 2: TECHNICAL APPENDICES Final Report
A. Holmes-Siedle 1978 67 p refs
(Contract ESA-2440/74-HP)
(FRI-R646/3-Vol-2; ESA-CR(P)-1176-Vol-2) Avail: NTIS HC A04/MF A01

Technical data supplementing volume one, including calibration data, TLD relativities, and a conference paper, are presented. The problem includes the dosimetry of radiation sources as well as the design and procurement of special dosimetric MOS devices (the TOT series). The devices were first used for laboratory dosimetry and, later, incorporated in two ESTEC flight units which are now monitoring internal radiation doses in geostationary orbit. Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-11414*# National Aeronautics and Space Administration, Washington, D. C.
SHUTTLE ATMOSPHERIC LIDAR RESEARCH PROGRAM Final Report
1979 231 p
(NASA-SP-433) Avail: NTIS HC A11/MF A01 CSCL 20E

The Shuttle atmospheric lidar program is discussed in relation to an understanding of the processes governing the Earth's atmosphere and in the capacity to evaluate the atmospheric susceptibility to manmade and natural perturbations. Applications of the lidar which are discussed are the determination of the global flow of water vapor and pollutants in the troposphere, improvement of chemical and transport models of the stratosphere and mesosphere, evaluation of radiative models of the atmosphere, investigation of chemistry and transport of thermospheric atomic species, and investigation of magnetospheric aspects of sun/weather relationships. The features of the lidar measurements discussed are the high spatial resolution, control of the source wavelength and intensity, and high measurement specificity. For individual titles, see N80-11415 through N80-11428.

N80-11415*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVES Final Report
In its Shuttle Atmospheric Lidar Res. Program 1979 p 7-9 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The features of the shuttle lidar experiments considered are the very good vertical resolution when used in the pulsed mode, fine horizontal resolution with the capability to probe the troposphere between the clouds, and very high sensitivity in aerosol and thin cloud detection. The ability to select atmospheric constituents by narrow spectral features, such as in resonant scatter or in absorption, the ability to measure temperatures of these constituents by the spectral shape of the features, given

adequate spectral purity of the laser, the ability to obtain global scale data rapidly, and the ability to point the lidar system in any direction, subject to the restriction of slew rate and scattered sunlight, are discussed. A.W.H.

N80-11416*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 1: GLOBAL FLOW OF WATER VAPOR AND POLLUTANTS
In its Shuttle Atmospheric Lidar Res. Program 1979 p 10-23 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The global flow of water vapor and pollutants in the troposphere and lower stratosphere is traced. Atmospheric transport processes are discussed. The use of trace constituents in the atmosphere for establishing the effects of the general circulation on the transport of pollutants is described. The use of Shuttle lidar for studies of aerosol transport is discussed and research topics are considered. A.W.H.

N80-11417*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 2: STRATOSPHERIC AND MESOSPHERIC CHEMISTRY AND TRANSPORT
In its Shuttle Atmospheric Lidar Res. Program 1979 p 24-33 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The tests and improvements for models of stratospheric and mesospheric chemistry and transport are discussed. The structure of the stratosphere and mesosphere, in terms of chemistry and dynamics, is reviewed. Current satellite experiments for long duration observation, focused on the measurement of aerosols and gases involved in the ozone-nitrogen chemistry of the stratosphere, are discussed. Future satellite experiments and Shuttle lidar contributions are proposed. A.W.H.

N80-11418*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 3: RADIATIVE MODELS
In its Shuttle Atmospheric Lidar Res. Program 1979 p 34-45 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The testing and improvements for atmospheric models of radiation, radiatively active substances, and radiative effects are discussed. The tests and improvements encompass two research areas. The first is that of providing input data for models which describe radiative energy exchange in the earth's atmosphere and the effects on this exchange of altered atmospheric composition. The second is that of providing input data for studies which test the basic assumptions used to analyze data from passive remote sensors. The alterations in the radiative energy exchange which alter the climate are examined. A.W.H.

N80-11419*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 4: METEOROLOGICAL DATA
In its Shuttle Atmospheric Lidar Res. Program 1979 p 46-57 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The augmentation of the meteorological data base using lidar and other sensors is discussed. The development of satellite temperature sounders and their application in understanding and forecasting weather is reviewed. The lidar technique combined with the method of differential to permit the direct measurement of either the surface pressure or cloud pressure heights is examined. The resolution and accuracies required of various parameters for improvements in weather forecasting and the performance that is expected from various lidar experiments are summarized. A.W.H.

N80-11420*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 5: UPPER ATMOSPHERIC WAVES
In its Shuttle Atmospheric Lidar Res. Program 1979 p 58-66 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The excitation, propagation, and dissipation of wave motions in the upper atmosphere is studied. The global morphology of mesospheric and thermospheric waves, the wave motions of all scales from 80 to 100 km altitude, the global morphology of lower mesospheric waves using the OH radical, and the wave motions of all scales in the stratosphere and their sources are discussed. A.W.H.

N80-11421*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 6: THERMOSPHERIC CHEMISTRY AND TRANSPORT
In its Shuttle Atmospheric Lidar Res. Program 1979 p 67-73 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The chemistry and transport of thermospheric atomic species is studied. The use of lidar, based on the simultaneous use of active and passive techniques for simultaneous global coverage of several atomic species together with the measurement of the dynamical parameters responsible for their transport, is discussed towards understanding the equilibrium of atomic species in the lower thermosphere. The role of eddy diffusion in the energy transport through the mesopause level is examined. The morphology of Na abundances and the origin of Na and K in the upper atmosphere is discussed. A.W.H.

N80-11422*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 7: MAGNETOSPHERIC SUN AND WEATHER RELATIONSHIPS
In its Shuttle Atmospheric Lidar Res. Program 1979 p 74-79 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

Possible mechanisms by which short term solar variability may effect the atmosphere are reviewed. If accompanied by an extensive supporting program of ground, rocket, and balloon measurements, lidar experiments may play a significant role in determining the (1) magnetospheric convection patterns of Mg(+); (2) chemical coupling from thermosphere to mesosphere; and (3) ozone heating effects on circulation. Requirements for sortie missions to study mesospheric aspects related to sun-weather interactions are tabulated. A.R.H.

N80-11423*# National Aeronautics and Space Administration, Washington, D. C.
CANDIDATE SHUTTLE LIDAR EXPERIMENTS
In its Shuttle Atmospheric Lidar Res. Program 1979 p 80-88 (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The degree of feasibility, probable measurements accuracy, and particular contributions to the relevant scientific objective were evaluated for twenty-six representative experiments designed to study the possible relationships between solar activity and meteorological variables. A hardware envelope was established for the shuttle lidar that will permit high confidence operation for those measurements whose operation is well defined and will also permit potential growth for generations of lidar measurements whose techniques are still under development. A.R.H.

N80-11424*# National Aeronautics and Space Administration, Washington, D. C.
SHUTTLE ATMOSPHERIC LIDAR PROGRAM EVOLUTION
In its Shuttle Atmospheric Lidar Res. Program 1979 p 89-94 (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

Because many of the specific lidar measurements of interest in the late 1980's cannot yet be foreseen, the hardware approach for a shuttle lidar system should be both modular and evolutionary. With a modular approach, the distinct components (laser transmitter, telescopic return-signal collector, detector, and data processing electronics) are readily interchangeable and can be replaced as appropriate to changing measurement needs and technology developments. With an evolutionary approach, the initial hardware complement for the simplest early experiments will be augmented by subsequent hardware additions to expand the lidar capability for more complex and more technologically demanding experiments. A.R.H.

N80-11425*# National Aeronautics and Space Administration, Washington, D. C.

APPENDIX A: DESCRIPTIONS OF SHUTTLE BORNE LIDAR EXPERIMENTS

In its Shuttle Atmospheric Lidar Res. Program 1979 p 95-162 refs (For primary document see N80-11414 02-36)

Avail: NTIS HC A11/MF A01 CSCL 20E

The purpose of twenty-six shuttle lidar experiments is summarized and the techniques used in each are described. Limiting factors and unique features are included with numerical values of the hardware parameters needed and the measurement accuracy obtainable with these parameters, as well as supporting evidence for the viability of the experiment. The feasibility rating and its rationale is given for each experiment. Critical areas which must be addressed before the experiment is considered ready for shuttle use, the relation of the experiment to science objectives, the uniqueness of the shuttle lidar measurement, and the particular correlative or supportive measurements needed are discussed. A.R.H.

N80-11426*# National Aeronautics and Space Administration, Washington, D. C.

APPENDIX B: LASERS OF POTENTIAL USE FOR SHUTTLE LIDAR

In its Shuttle Atmospheric Lidar Res. Program 1979 p 163-174 *ref (For primary document see N80-11414 02-36)*

Avail: NTIS HC A11/MF A01 CSCL 20E

The remote identification of particulates as well as atomic and molecular species from the Space Shuttle platform requires pulsed lasers for active (lidar) detection or CW lasers for passive (heterodyne) detection. The detection of atomic species usually limits the laser source to the visible or ultraviolet spectral regions, while molecular species have many of their spectral signatures (vibrational-rotational transitions) in the mid-infrared (2 to 20 micron m). The detection of particulates (clouds and aerosols) is best done using lasers which operate in the visible to the near infrared regions where elastic scattering cross sections are large. Topics discussed include Nd:Yag lasers, carbon dioxide lasers, dye lasers, rare gas-halide lasers, semiconductor lasers, and nonlinear conversion of laser frequency. A.R.H.

N80-11427*# National Aeronautics and Space Administration, Washington, D. C.

APPENDIX C: TRANSMITTING AND RECEIVING OPTICS CONSIDERATIONS

In its Shuttle Atmospheric Lidar Res. Program 1979 p 175-192 ref (For primary document see N80-11414 02-36)

Avail: NTIS HC A11/MF A01 CSCL 20E

To define detailed requirements for a Shuttle lidar receiving optics system, the application or set of applications for which it is to be used must be considered. Fortunately, however, most atmospheric applications require a similar class of receiving optics which is well within the state of the art and, therefore, general requirements can be bounded. Limits for the various hardware parameters can be used to produce an initial design concept. Convolved with these hardware considerations, such as instantaneous field of view, area, baffling, wavelength range, size, weight, thermal and mechanical stability, surface quality, etc., are economic trade-offs, such as cost and Shuttle power versus weight, and considerations for eye safety. In addition, considerations for pointing and the accommodation of different detection systems must be examined. A.R.H.

N80-11428*# National Aeronautics and Space Administration, Washington, D. C.

APPENDIX D: SPECTRAL DISCRIMINATORS AND DETECTORS FOR SHUTTLE LIDAR

In its Shuttle Atmospheric Lidar Res. Program 1979 p 193-218 refs (For primary document see N80-11414 02-36)

Avail: NTIS HC A11/MF A01 CSCL 20E

Possible methods and hardware available for spectrally isolating (or analyzing) and for detecting the received lidar signal are surveyed. The most promising candidates are summarized, and other candidates and more detailed characteristics of all candidates are described. A.R.H.

N80-11429# Raytheon Co., Wayland, Mass. Advanced Development Lab.

TEN POINT SIX MICRON LASER TARGET DESIGNATOR Final Report, 15 Nov. 1975 - 31 Mar. 1978

R. I. Rudko Nov. 1978 41 p refs

(Contract DAAB07-76-C-08; DA Proj. 1L1-62703-DH-93)

(AD-A071912; BR79-4167; DELNV-TR-76-0830-F) Avail: NTIS HC A03/MF A01 CSCL 20/5

A research version of a 10.6 micron laser designator was constructed. The device weighs 26 lbs without power supply. Output energy of 100 mJ in 30 nsec pulses at 2 - 20 pulses per second with a 1.5 percent overall efficiency were achieved. GRA

N80-11430# Naval Air Development Center, Warminster, Pa. Sensors and Avionics Technology Directorate.

LASER IRRADIANCE IN THE SEA: THEORY AND EXPERIMENT

Lloyd C. Bobb, Gerald Ferguson, and Michael Rankin Sep. 1978 45 p refs

(ZR00001)

(AD-A072601; NADC-78253-30) Avail: NTIS HC A03/MF A01 CSCL 20/5

Laser beam spreading due to the air/sea interface, volume scattering, and initial beam divergence is modeled. Beam steering is considered for the case in which the laser beam diameter is small compared to the length of the refracting wave. An expression is developed for the irradiance as a function of depth into the ocean. A comparison of the terms in this expression shows that the surface spreading effect is small compared with bulk scattering. Wavetank experiments were performed. The height, slope, and frequency content of wind-driven capillary waves are reported for wind speeds in the range 2.2 m/sec to 7.6 m/sec. GRA

N80-11431# Laser Diode Labs., Inc., Metuchen, N. J.

***INJECTION LASER DIODES FOR FIBER OPTIC COMMUNICATIONS* Quarterly Report, 1 Jul. - 30 Sep. 1977**

Rob Adair 15 Jun. 1978 41 p

(Contract DAAB07-76-C-0040)

(AD-A072504; QR-5) Avail: NTIS HC A03/MF A01 CSCL 09/1

The design and fabrication of injection laser diodes for use in fiber optic communications is discussed with regard to material synthesis, chip configuration, and device assembly in manufacturing environment. The opto-electronic source is based on the GaAs-GaAlAs double heterojunction structure and consists of a parallel array of lasers formed by the application of triple stripe geometry to the surface of the epitaxial wafer. The monolithic triad of discrete lasing elements is mounted in a high frequency package which incorporates a high quality optical window. GRA

N80-11432# Sperry Univac, St. Paul, Minn. Applied Physics Lab.

LASER DEFLECTION ANALYSIS Final Report, Jul. 1977 - Aug. 1978

F. G. Hewitt, G. L. Nelson, and J. A. Krawczak May 1979 74 p

(Contract F33615-77-C-1163; AF Proj. 2001)

(AD-A072560; AFAL-TR-78-193) Avail: NTIS HC A04/MF A01 CSCL 17/5

The objective of this program was to provide mathematical analysis for the use of laser beam deflection in various potential applications. The analysis considered the effects of beam divergence, pointing accuracy, and signal-to-background noise. The analysis was supported by experimental measurements of relevant factors involved in the laser deflection process. GRA

N80-11433# Bala, Cupertino, Calif.

DESIGN OF AN EXPERIMENTAL PROGRAM FOR EVALUATION OF LBR SYSTEMS

N. Balasubramanian 6 Apr. 1979 48 p

(Contract DAAK70-78-C-0125)

(AD-A071526; ETL-0182) Avail: NTIS HC A03/MF A01 CSCL 14/3

Design and characteristics of an experimental laser beam recording system (LBR) is presented. The experimental LBR has a scanning subsystem serving both as an image sampler and an image recorder. Specific recommendations for an experimental program are outlined to evaluate EBR parameters and trade offs for selected applications. GRA

N80-11434# Illinois Univ. at Urbana-Champaign. Electro-Physics Lab.

OPTICALLY PUMPED FAR INFRARED LASERS Final Report, 1 Aug. 1978 - 31 Jan. 1979

T. A. DeTemple and Paul D. Coleman Mar. 1979 45 p refs (Grant DAAG29-78-G-0128)

(AD-A071836; UILU-ENG-79-2547; ARO-15641.2-P) Avail: NTIS HC A03/MF A01 CSCL 20/5

Experiments and theory regarding the emission processes in optically pumped far infrared laser sources are reported. Super-radiance from CH3F at 496 micrometers in the homogeneously broadened regime has been identified for the first time. Stimulated Raman emission on pure rotational transitions in D2O at 50 and 66 micrometers has also been identified for the first time. Generally good agreement between experiments and a Maxwell-Bloch approach was obtained for the super-radiance study, and good qualitative agreement between experiments and a Maxwell-density matrix approach using three waves interacting in a four-level system was noted for the Raman study; both implying that the processes are now reasonably well characterized and understood. GRA

N80-11435# Stanford Univ., Calif. Edward L. Ginzton Lab.

LASER PHYSICS AND LASER TECHNIQUES Annual Report, 1 Jan. - 31 Dec. 1978

A. E. Siegman and R. L. Byer Apr. 1979 177 p refs (Contract F49620-77-C-0092; AF Proj. 2301)

(AD-A072009; GL-2953; AFOSR-79-0891TR) Avail: NTIS HC A09/MF A01 CSCL 20/5

A program of basic research in laser physics and laser techniques has been carried out in order to help meet Air Force mid-term and long-term requirements as outlined in the AFSC Research Planning Guide. A Fast Hankel transform algorithm has been developed and applied to nonlinear interactions and to diffraction biased resonators studies. Picosecond spectroscopy via the induced grating approach has been successfully used to study fast relaxation processes. Optical parametric amplifiers and oscillators have been shown to be useful sources of coherent radiation over the 0.4 to 4 micrometers spectral range. Finally, stimulated Raman scattering and four-wave mixing has been used for efficient frequency conversion in the infrared. Detailed studies have shown excellent theoretical and experimental agreement in the Raman interactions. GRA

N80-11436# TRW Defense and Space Systems Group, Redondo Beach, Calif.

ADVANCED LASER CONCEPTS. ADDENDUM: PRODUCTION OF EXCITED STATES Final Report, 6 Apr. 1976 - 6 Dec. 1977

D. J. Miller Kirtland AFB, N. Mex. AFWL May 1979 101 p refs

(Contract F29601-76-C-0065; ARPA Order 2861; AF Proj. 1256)

(AD-A071393; AFWL-TR-77-234) Avail: NTIS HC A06/MF A01 CSCL 20/5

Experiments are described which use an exclusively chemical system to generate the necessary reagents and energy transfer partners required for production of the a 1 Delta and b 1 Sigma - electronic excited states of the NF molecule. The purpose is to assess the potential for the development of an electronic transition chemical laser operating on the NF transitions at wavelengths of 874 nm or 529 nm. In the first of these experiments, staged combustion in a laser cavity is employed by adding a second mixer downstream from the cavity mixer in a conventional, supersonic, diffusion mixing HF chemical laser. This allows for the mixing of F-atoms, H2, and N2F4 the starting reagents required in the NF system. The second set of experiments utilized a tristream HF chemical laser nozzle which allows the three reagents F-atoms, H2, and N2F4 to be mixed in the throat of a supersonic slit nozzle. In both sets of experiments, thermal dissociation of N2F4 was the limitation for the final concentration of NF excited states. In both experiments the quenching of NF excited states is slow. GRA

N80-11437# Army Missile Research and Development Command, Redstone Arsenal, Ala. High Energy Laser and Research Lab.

COMPILATION OF DATA RELEVANT TO NUCLEAR PUMPED LASERS, VOLUME 1

E. W. McDaniel, M. R. Flannery, E. W. Thomas, H. W. Ellis, and K. J. McCann Dec. 1978 587 p refs

(AD-A071360; DRDMI-H-78-1-Vol-4) Avail: NTIS HC A24/MF A01 CSCL 20/5

This volume and volumes III and V contain a compilation of data relevant to nuclear pumped lasers and are part of a series on atomic and molecular data for gas laser research and development. Volume IV contains data on many different species on atoms, molecules and ions, a large fraction of them are already of direct interest in laser media, many more may become important in the future. GRA

N80-11438# Naval Research Lab., Washington, D. C.

RIGOROUS DERIVATION OF GENERAL DISPERSION RELATIONSHIP FOR GYROTRON

Saeyoung Ahn and Joon Y. Choe Jul. 1979 42 p refs

(AD-A072005) Avail: NTIS HC A03/MF A01 CSCL 20/5

General dispersion equation for the electron cyclotron maser instability in co-axial cylindrical geometry is derived in the framework of linearized Vlasov-Maxwell system. While previous works have been carried out for the azimuthally symmetric mode and for the specified equilibrium electron distribution function in simple waveguide structure, we have extended our analysis to include the azimuthally mode with general equilibrium distribution function. After selfconsistent analysis of the equilibrium distribution function, we have solved the orbit integral for the perturbed distribution function closely following the previous analysis by Chu, and have derived a new rigorous formal dispersion equation for arbitrary equilibrium distribution function. The resulting equation is useful to find the dispersion relation of electron beam with spread in energy and momenta. A closed form of dispersion relation for the cold beam electrons is given as an example. GRA

N80-11439# Colorado Univ. at Boulder.

OPTICAL AND DISCHARGE STUDIES OF NOVEL ELECTRONIC TRANSITION LASER SPECIES Interim Report

Stephen R. Leone Jun. 1979 6 p

(Contract N00014-77-C-0115)

(AD-A071853) Avail: NTIS HC A02/MF A01 CSCL 20/5

Summary of Conclusions from the Discharge S2 Laser Work: Electric discharges in pure S2 vapor do produce brilliant blue glow discharges characteristic of the S2(B-X) emission; Sulfur vapor is extremely corrosive and is effectively incompatible with all metal materials at 600 C. GRA

N80-11440# Air Force Weapons Lab., Kirtland AFB, N. Mex.

MODELING STUDIES OF THE MIXING AND CHEMISTRY OF THE NF RADICALS ON THE TRISTREAM NOZZLE Final Report

R. A. Armstrong and N. L. Rapagnani Jun. 1979 27 p refs (AF Proj. 3326)

(AD-A071315; AFWL-TR-78-263163) Avail: NTIS HC A03/MF A01 CSCL 20/5

Among the many systems being investigated in the effort to develop a thermochemically pumped electronic transition laser, the NF radical has shown high promise. This report describes the modeling completed to evaluate an NF mixing concept. Calculations were made with varying expansion ratios, both in the nozzle and cavity, to determine the optimum throat pressures, throat temperatures and element lengths. The mixing concept as described is very promising and could last if the optical path length is long enough. GRA

N80-11441# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.

LASER INDUCED LUMINESCENCE OF MILITARY TARGETS

L. M. Narducci and H. C. Meyer 13 Mar. 1979 22 p refs

(AD-A073200; DRDMI-T-79-31) Avail: NTIS HC A02/MF A01 CSCL 17/8

The objective of this report is to identify specific problems where laser induced luminescence may prove useful to current Army remote sensing system and terminal homing devices. Luminescence, as any other molecular emission process (e.g., Raman emission), is typical of a particular molecular system

and should provide the basis for discrimination of a given target if sufficient spectral resolution is employed. GRA

N80-11442# California Univ., Livermore. Lawrence Livermore Lab.

ADVANCED LASERS FOR FUSION APPLICATIONS

W. F. Krupke Nov. 1978 25 p refs Presented at Intern. Conf. on Laser, San Diego, Calif., 20 Aug. 1978

(Contract W-7405-eng-48)

(UCRL-81940; Conf-7808106-1) Avail: NTIS HC A02/MF A01

Producing commercial fusion power using inertial confinement techniques is discussed. Repetitively pulsed laser systems for fusion reactor drive are examined. The projected efficiencies of a number of driver laser systems based on selected new laser media and excitation techniques are reported and physical and technological scaling issues are identified. The systems are compared with driver systems based on more developed laser media. A.W.H.

N80-11443 This accession not used.

N80-11444# Oak Ridge Y-12 Plant, Tenn.

LASERS IN MACHINE TOOL CONTROLS

Robert R. Burleson Apr. 1979 9 p Presented at Westinghouse Machine Tool Forum, Pittsburgh, 4 Jun. 1979

(Contract W-7405-eng-26)

(Y/DA-8211; Conf-790639-1) Avail: NTIS HC A02/MF A01

A system for measuring the parameters which determine the dynamic the dynamic characteristics of a numerically controlled machine is presented. A system to correct for those errors is discussed. Both systems utilize a laser interferometer as the measurement transducer. The machining of optical quality surfaces required for the laser fusion program is considered. DOE

N80-11445# Brookhaven National Lab., Upton, N. Y.

FREE ELECTRON LASER AND ITS POSSIBLE DEVELOPMENTS

C. Pellegrini 1979 7 p refs Presented at the 1979 Particle Accelerator Conf., San Francisco, 12-14 Mar. 1979

(Contract EY-76-C-02-0016)

(BNL-25857; Conf-790307-70) Avail: NTIS HC A02/MF A01

The basic characteristics of a free electron laser in a storage ring are reviewed. Some of the more recent works and ideas and how performance of the laser might be improved are described. DOE

N80-11446# Los Alamos Scientific Lab., N. Mex.

LASL PROGRAM IN NUCLEAR PUMPED LIQUID LASERS

Charles R. Mansfield, Paul F. Bird, and John F. Davis 1978 9 p refs Presented at First Intern. Symp. on Fission Induced Plasmas and Nucl.-Pumped Lasers, Orsay, France, 23 May 1978

(Contract W-7405-eng-36)

(LA-UR-78-3016; Conf-780537-4) Avail: NTIS HC A02/MF A01

The suitability of the lanthanide rare earths for nuclear pumped lasers is considered. Four of the rare earth ions with high pumped laser output are Eu(+3), Tb(+3), Nd(+3), and Pm(+3). A sixty fold increase in pumping efficiency was observed with the addition of a mixture of uranyl and neodymium ions at 1.06 microns. DOE

N80-11447# Los Alamos Scientific Lab., N. Mex.

NUCLEAR PUMPED ELECTRONIC TRANSITION LASER STUDIES

W. M. Hughes and H. H. Helmick 1978 15 p refs Presented at First Intern. Symp. on Fission Induced Plasmas and Nucl.-pumped Lasers, Orsay, France, 23 May 1978

(Contract W-7405-eng-36)

(LA-UR-78-3015; Conf-780537-3) Avail: NTIS HC A02/MF A01

The subjects discussed are: (1) an outline of experiments and theoretical considerations for determining the production efficiency of excited states using high energy fission fragments; (2) calculation of the excited state production rate required for efficient laser operation; and (3) indication of the desirability to match the fission power pulse shape to the laser system considered. KrF is used as an example. DOE

N80-11448# Bendix Corp., Kansas City, Mo.

LASER-BEAM PROFILER AND DETECTOR-SURFACE SCANNER

L. R. Foulk Nov. 1978 32 p refs Revised

(Contract EY-76-C-04-0613)

(BDX-613-1841-Rev) Avail: NTIS HC A03/MF A01

A portable, relatively inexpensive laser-beam profiler and detector-surface scanner was developed to map the intensity profile of laser beams and the cross-sectional response of optical detectors within a wavelength range of 633 nm to 10.6 micrometers. Equipment diagrams, circuit schematics, and examples of detector-response maps and laser-beam profiles are provided. Intensity distribution is an important parameter in obtaining good laser welds, and a knowledge of detector response is essential in determining the accuracy of laser power measurements. DOE

N80-11449# California Univ., Livermore. Lawrence Livermore Lab.

FLUORESCENCE DIAGNOSTICS IN TWO-STEP LASER EXCITATION OF HIGH J ATOMS

Richard C. Stern, Bruce W. Shore, and Neil C. Lang 5 Apr. 1979 15 p Presented at ACS Conf., Honolulu, Haw., 1 Apr. 1979

(Contract W-7405-eng-48)

(UCRL-81746; Conf-790415-14) Avail: NTIS HC A02/MF A01

Using a pair of lasers near 6000 A, the J = 6 ground state is excited to a J = 6 intermediate level and then to a J = 5 upper state. Nonresonant fluorescences from both excited states are separately detected. Results of a set of model calculations are tabulated. Level 3 average populations are always very small, since the system decays rapidly into inaccessible metastable states. This means that chmistry experiments are difficult. The differences between parallel and perpendicular polarization are modest. The fluorescence dips converge to a value near 50%. The level 3 populations do not approach a common value. This means that the most reliable experimental measurement does not determine the level populations. The most striking changes appear in the last two, most exact, models. The difference between the models is that one includes, for the first time, the linear frequency chirp produced by the fanlike spread of the focussed laser beams. This seemingly innocuous change halves the population left in the ground state. DOE

N80-11450# Sandia Labs., Albuquerque, N. Mex.

RADIAL ELECTRON BEAM LASER EXCITATION: THE REBLE REPORT

J. J. Ramirez and Kenneth R. Prestwich Oct. 1978 101 p refs

(Contract EY-76-C-04-0789)

(SAND-78-2005) Avail: NTIS HC A06/MF A01

The results of an investigation of techniques to generate high power radially converging electron beams and the application of these beams to gas lasers was discussed. The design and and performance of the REBLE accelerator that was developed is presented. The measured total and spatially resolved energy deposition of this radial electron beam in various gases is compared with Monte Carlo calculations. In most cases, these codes give an accurate description of the beam transport and energy deposition. With the electron beam pumping xenon gas, the amplitude of xenon excimer radiation (1720 A) a radially uniform to within the experimental uncertainty. The efficiency of converting

deposited electron beam energy to xenon excimer radiation is 20%. DOE

N80-11451# California Univ., Livermore. Lawrence Livermore Lab.

MEASUREMENT OF FLUORESCENCE DECAY TIMES OF LASER DYES, 1. BEHAVIOR OF RIGID AND MOBILE MEDIA WITH RESPECT TO SIGNAL EXTRACTION AND SIGNAL PROPAGATION, 2

P. P. Hammond 3 Jul. 1978 16 p Presented at the Office of Naval Res. Review Meeting, Cambridge, Mass., 8 Sep. 1978

(Contract W-7405-eng-48)

(UCRL-81568; Conf-780965-1) Avail: NTIS HC A02/MF A01

Experimental techniques are described that distinguish or avoid these errors and that permit the measurement of accurate decay times and quantum yields. As a signal propagates and amplifies in a dye laser medium, the average excited state lifetime expectancy, or turnover time of the dye molecules becomes shorter and shorter. As it becomes comparable to the orientational relaxation time, propagation occurs through a mobile, viscous and rigid medium in turn. Extraction of stored energy and signal propagation are examined for the two extreme situations-mobil and rigid media. DOE

N80-11452# California Univ., Livermore. Lawrence Livermore Lab.

EFFECTS OF LONGITUDINAL ELECTRIC SELF-FIELD ON THE ACCEPTABLE ENERGY SPREAD IN A FREE ELECTRON LASER

V. K. Neil 27 Nov. 1978 9 p

(Contracts W-7405-eng-48; ONR-79-F-0004)

(UCID-17985) Avail: NTIS HC A02/MF A01

The final stable phase area in a free electron laser is calculated taking into account the longitudinal electric self-field of the electrons. The calculation is static: longitudinal plasma oscillations are not treated. K.L.

N80-11453# California Univ., Livermore. Lawrence Livermore Lab.

JANUS NEODYMIUM GLASS LASER OPERATIONS MANUAL

J. M. Auerbach, N. C. Holmes, and R. J. Trainor 29 Sep. 1978 80 p

(Contract W-7405-eng-48)

(UCID-17952) Avail: NTIS HC A04/MF A01

A manual, prepared to guide personnel in operating and maintaining the Janus glass laser system, is presented. System components are described in detail. Step by step procedures are presented for firing the laser and for performing routine maintenance and calibration procedures. DOE

N80-11454# California Univ., Livermore. Lawrence Livermore Lab.

LASER INDUCED FLUORESCENCE EXTENSION TO NON-FLUORESCENT MATERIALS

G. R. Haugen, J. H. Richardson, J. E. Clarkson, and G. M. Hieftje Oct. 1978 5 p refs Presented at the Workshop on Detection and Identification of Explosives, Reston, Va., 30-31 Oct. 1978

(Contract W-7405-eng-48)

(UCRL-81337; Conf-7810115-4) Avail: NTIS HC A02/MF A01

It was demonstrated that laser induced fluorescence (LIF) was a highly sensitive (sub-parts-per-trillion) technique for general application to trace chemical analysis. To gain enhanced selectivity, LIF was combined with separation capability of chromatographic techniques. A new approach being studied is to use fluorescent quenching as the means of quantitative detection of nonfluorescent materials. This technique along with chromatographic separation greatly increases the number of compounds which can be analyzed by LIF. GRA

N80-11455# California Univ., Livermore. Lawrence Livermore Lab.

LASER INDUCED DAMAGE IN FLUORIDE GLASSES: A STATUS REPORT

S. E. Stokowski, D. Milam, and M. J. Weber 27 Sep. 1978 15 p refs Presented at the Symp. on Opt. Mater. for High Power Lasers (Damage Symp.), Boulder, Colo., 12-14 Sep. 1978

(Contract W-7405-eng-48)

(UCRL-81358; Conf-780977-3) Avail: NTIS HC A02/MF A01

Bulk and surface damage thresholds of fluorophosphate and fluoroberyllate glasses have been measured for 1-ns 1064-nm laser pulses. For crystal-free samples, threshold values for fluoride glasses are comparable to those measured in optical quality fused silica and borosilicate glasses. However, for many samples investigated, the presence of solid inclusions results in low damage thresholds. Some examples of solid inclusions are shown and discussed. Surface damage thresholds in FK-51 fluorophosphate glass are uniformly high and exhibit an approximated square root dependence on pulse duration in the range of 0.1 to 1.0 ns. DOE

N80-11456# Bendix Corp., Kansas City, Mo. Kansas City Div.

CHARACTERISTICS OF LASER CUTTING KEVLAR LAMINATES

R. A. VanCleave Jan. 1979 28 p refs

(Contract EY-76-C-04-0813)

(BDX-613-2075-Rev) Avail: NTIS HC A03/MF A01

Comparison of laser-cut and machined samples of Kevlar/epoxy laminates has shown that material properties are not degraded by use of the laser. With present techniques and a 1000-W CO2 laser, the maximum laminate thickness that can be cut satisfactorily is 9.5 mm. Power requirements, edge taper, and kerf width for various thicknesses were established. Partial depth cuts, controlled and repeatable to within 0.5 mm, were produced in Kevlar/epoxy laminates by scanning the material under a pulsed beam. Fumes produced during cutting operations require proper exhaust methods to avoid long exposures to benzene, a potential carcinogen. DOE

N80-11457# Central Electricity Generating Board, Heysham (England). Scientific Services Dept.

LASER SCANNING CAMERA

M. Jagger, inventor May 1979 4 p

(TDB-324) Avail: NTIS HC A02/MF A01

A camera suitable for inreactor surveys is described. The camera embodies a scanning principle similar to that in the scanning electron microscope. It consists of a laser beam scanning head and a photosensitive detector. The scanning head consists of two plane mirrors which vibrate about orthogonal axes arranged in such a way that a laser beam, when directed into the arrangement, will be doubly reflected and emerge to scan in a raster over the surface of the object to be examined. The amount of light reflected at any time is controlled by the properties of the surface at each point in the scan and thus the signal from the detector can be used to modulate the brightness of a TV raster scanned in synchronism with the laser beam to produce a TV picture of the object. Author (ESA)

N80-11458# New Mexico Univ., Albuquerque. Technology Application Center.

GALLIUM ARSENIDE LASERS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jul. 1979

Samuel C. Mauk Aug. 1979 47 p Sponsored in part by NTIS

(NTIS/PS-79/0821/3) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

This bibliography cites 226 articles from the international literature concerning the research, testing, and applications of gallium arsenide and aluminum gallium arsenide double heterojunction lasers. GRA

N80-11459# National Technical Information Service, Springfield, Va.

LASER CUTTING AND MACHINING: METALS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1979

Guy E. Habercom, Jr. Sep. 1979 282 p Supersedes NTIS/PS-78/0852; NTIS/PS-77/0722

(NTIS/PS-79/0890/8; NTIS/PS-78/0852; NTIS/PS-77/0722) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Techniques for metalworking, machining, and cutting by use of controlled laser beams are investigated in these reports gathered *in worldwide literature surveys. Precision finishing of metal* surfaces is described. The thermal response of various metals is evaluated. This bibliography contains 275 abstracts, 23 of which *are new entries to the previous edition.* DOE

N80-11480# New Mexico Univ., Albuquerque. Technology Application Center.
DYE LASERS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jul. 1979
Samuel C. Mauk Aug. 1979 55 p Sponsored in part by NTIS
(NTIS/PS-79/0823/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

This bibliography cites 279 articles concerning continuous wave, pulsed, ultrashort pulsed, ultraviolet, and infrared dye lasers. Articles covering laser outputs, materials, and applications are stressed. GRA

N80-11481# New Mexico Univ., Albuquerque. Technology Application Center.
NEODYMIUM YAG LASERS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jul. 1979
Sep. 1979 43 p Sponsored in part by NTIS
(NTIS/PS-79/0862/7) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

This bibliography cites 190 reports on neodymium YAG lasers. Included are articles covering laser materials and outputs; laser mode locking; crystal, fiber, and nonlinear optics; optical pumping communications; energy conversion efficiency; and laser applications. Articles covering pulsed, continuous wave, solid state, Q switched, and infrared lasers, are included. GRA

N80-11482# New Mexico Univ., Albuquerque. Technology Application Center.
ULTRAVIOLET LASERS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1975 - Jul. 1979
Samuel C. Mauk Sep. 1979 46 p Sponsored in part by NTIS
(NTIS/PS-79/0861/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

This bibliography cites 217 reports from the international literature on ultraviolet lasers. Included are articles covering laser outputs, far ultraviolet radiation, electron pumping, otpical pumping, and laser materials. Articles concerning gas lasers, pulsed lasers, dye lasers, CO2 lasers, xenon fluoride lasers, and transversely excited atmospheric (TEA) lasers are included. GRA

N80-11483# New Mexico Univ., Albuquerque. Technology Application Center.
HYDROGEN FLOURIDE AND DEUTERIUM FLUORIDE LASERS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1979
Samuel C. Mauk Sep. 1979 51 p Sponsored in part by NTIS
(NTIS/PS-79/0860/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

This bibliography cites 230 reports from the international literature on hydrogen fluoride and deuterium fluoride lasers. Included are articles covering flows, laser outputs, molecular relaxation, molecular rotation, energy conversion efficiency, reaction kinetics and laser materials. Articles are included on both continuous wave and pulsed lasers. GRA

N80-11484# National Technical Information Service, Springfield, Va.
LASER CUTTING AND MACHINING: NONMETALS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1979
Guy E. Habercom, Jr. Sep. 1979 136 p Supersedes NTIS/PS-78/0853, NTIS/PS-77/0723
(NTIS/PS-79/0891/6; NTIS/PS-78/0853; NTIS/PS-77/0723) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Techniques for electrothermal cutting and machining of glass, fabrics, wood, plastics, and other nonmetal products by use of controlled laser beams are described in these reports gathered *in world-wide literature surveys. Thermal analyses of materials* exposed to laser beams are investigated. This updated bibliography contains 130 abstracts, 15 of which are new entries to the previous edition. GRA

N80-11485# National Technical Information Service, Springfield, Va.
DYE LASERS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Aug. 1979
Diane M. Cavagnaro Sep. 1979 275 p Supersedes NTIS/PS-78/0872, NTIS/PS-77/0724, NTIS/PS-76/0614, NTIS/PS-75/539 and NTIS/PS-74/120
(NTIS/PS-79/0894/0; NTIS/PS-78/0872; NTIS/PS-77/0724; NTIS/PS-76/0614; NTIS/PS-75/539; NTIS/PS-74/120) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

The citations present studies on dye laser theory, design, components, optical systems, and frequency range. Abstracts on lasing dyes, pumping, tuning, excitation, molecular structure, and modulation are included. Studies on dye laser use in spectroscopy are covered. This updated bibliography contains 268 abstracts, 67 which are new entries to the previous edition. GRA

N80-11486# National Technical Information Service, Springfield, Va.
NEODYMIUM YAG LASERS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Brian Carrigan Sep. 1979 172 p Supersedes NTIS/PS-78/0808
(NTIS/PS-79/0883/3; NTIS/PS-78/0808) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

Federally-funded research reports on lasing of neodymium doped yttrium aluminum garnet are cited. Studies on design, fabrication, quantum efficiency, light pulses, stabilization, and testing are covered. Optical pumping, mode locking, frequency conversion, and modulation of these lasers are discussed. Laser applications such as optical communications range finding, and tracking are included. Safety hazards and radiation damage related to neodymium YAG lasers are also covered. This updated bibliography contains 166 abstracts, 17 of which are new entries to the previous edition. GRA

N80-11487# National Technical Information Service, Springfield, Va.
GAS DYNAMIC LASERS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Brian Carrigan Aug. 1979 256 p Supersedes NTIS/PS-78/0829, NTIS/PS-77/0726, NTIS/PS-75/573 and NTIS/PS-75/018
(NTIS/PS-79/0839/5; NTIS/PS-78/0829; NTIS/PS-77/0726; NTIS/PS-75/573; NTIS/PS-75/018) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

The citations cover research on kinetic and energy transfer processes, design, optics, nozzles, and performance of gas and chemical lasers relying on gas dynamic effects for lasing enhancement. Diffusion and flow studies specifically applicable to such lasers are also included. (This updated bibliography contains 247 abstracts, 11 of which are new entries to the previous edition. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-11488*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INDUCTION HEATING GUN Patent Application
John D. Buckley, Robert J. Swaim, and Robert L. Fox, inventors (to NASA) Filed 24 Aug. 1979 14 p
(NASA-Case-LAR-12540-1; US-Patent-Appl-SN-069429) Avail: NTIS HC A02/MF A01 CSCL 13I

A device was developed for inductively heating and fusing thermoplastics. The device includes an alternating current passing

through a tank circuit and an inductor member of the tank circuit being wrapped around a curved pole piece of a ferromagnetic material. The magnetic flux arising within the inductor coil member flows to the ends of the pole piece and into a screen placed between the materials to be joined. The flux induces a current in the screen, and heat is generated to melt the thermoplastics together. Because only 30-150 watts of power are passed through the tank circuit, a wire which will remain cool under operational wattage may be selected, making air or fluid cooling unnecessary. NASA

N80-11469*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ONE STEP DUAL PURPOSE JOINING TECHNIQUE
John D. Buckley, Robert J. Swaim, and Robert L. Fox, inventors (to NASA) 30 Aug. 1979 9 p
(NASA-Case-LAR-12595-1; US-Patent-Appl-SN-070774) Avail: NTIS HC A02/MF A01 CSCL 13I

A fastener to be used between two organic matrix composite objects for induction heating and joining purposes was developed. The fastener is comprised of a wire screen made of a high resistance, low reluctance material such as carbon steel. Selected wires of copper or similar conductive material, are integrated within the screen; these wires are insulated in a sheath 20 of enamel or similar oxidation-resistant, high temperature sustaining material. When placed between two sheets of thermoplastic, the screen may be used for induction heating and fusing of the thermoplastic. Upon application of inductive heating technique, the wires become hot and cause the thermoplastic to melt and fuse together around the screen. After cooling, the wires are capable of carrying electric current along the now-joined thermoplastics. The novel feature of the invention is the inclusion of conductive elements in an inductive heating fastener. NASA

N80-11470*# Beech Aircraft Corp., Boulder, Colo.
PRSA HYDROGEN TANK THERMAL ACOUSTIC OSCILLATION STUDY Final Report
D. H. Riemer Sep. 1979 76 p refs
(Contract NAS2-10229)
(NASA-CR-152319; BAC-ER-14887) Avail: NTIS HC A05/MF A01 CSCL 13G

The power reactant storage assembly (PRSA) hydrogen tank test data were reviewed. Two hundred and nineteen data points illustrating the effect of flow rate, temperature ratio and configuration were identified. The test data were reduced to produce the thermal acoustic oscillation parameters. Frequency and amplitude were determined for model correlation. A comparison of PRSA hydrogen tank test data with the analytical models indicated satisfactory agreement for the supply and poor agreement for the full line. R.C.T.

N80-11471# Florida Univ., Gainesville. Rotordynamics Lab.
INVESTIGATION OF LOAD-INDUCED NON-SYCHRONOUS WHIRL INSTABILITIES IN ROTATING MACHINERY Final Report, 15 Sep. 1977 - 31 Mar. 1979
John M. Vance, George N. Sandor, Kenneth E. Ard, and Frank J. Laudadio Mar. 1979 126 p refs
(Grant DAAG29-77-G-0217)
(AD-A071716; ARO-1915041.2-E) Avail: NTIS HC A07/MF A01 CSCL 20/11

Seven tasks are described which were designed to reach the objectives. At the time of termination of the grant, these tasks were in various stages of completion, as described in this report. Tasks 1 and 2: Experimental Verification of 'Torquewhirl'; Task 3: Measurement of the Alford Force; Task 4: Comparison of Test Data with Theory; Task 5: Inclusion of a More General Shaft Flexibility in the 'Torquewhirl' Theory; Task 6: Derivation of the Linearized Stiffness Damping, and Cross-Coupling for Use in a Computer Stability Analysis; and Task 7: Load-Dependent Stability Predictions for a Machine of Realistic Complexity. GRA

N80-11472# IIT Research Inst., Chicago, Ill. Laser Center.
DEVELOPMENT OF LASER WELDING TECHNIQUES FOR JOINING ARMOR
F. D. Seaman 31 Mar. 1979 24 p
(Contract DAAK30-78-C-0118)
(AD-A072537; IITRI-B6157-Q2) Avail: NTIS HC A02/MF A01 CSCL 13/8

The multikilowatt laser as an industrial tool in the production line has now been accepted for three years. Recently, the laboratory feasibility of heavy-penetration laser welding was demonstrated in low strength steel. This program describes the establishment of laser welding process parameters that will produce a sound, cost-effective joint with ballistic potential of 1 1/2 in. armor plate. Sufficient production, test, and operational data will be prepared to permit a detailed analysis of the achievement of this objective and repeatability of the process. GRA

N80-11473# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF LASER WELDING TECHNIQUES FOR JOINING ARMOR Quarterly Report, 1 Oct. - 31 Dec. 1978
F. D. Seaman 31 Dec. 1978 26 p
(Contract DAAK30-78-C-0118)
(AD-A072536; IITRI-B6157-Q1) Avail: NTIS HC A03/MF A01 CSCL 13/8

The laboratory feasibility of heavy penetration laser welding was recently demonstrated in low strength steel. The objective of this program is the establishment of laser welding process parameters that will produce a sound, cost-effective joint with ballistic potential in 1-1/2 in. armor plate. Sufficient production, test, and operational data will be prepared to permit a detailed analysis of the achievement of this objective and repeatability of the process. Ballistic testing is not within the scope of this initial work. The program material is MIL-A-12560C(MR) (Mn-Mo) 1-1/2 in. armor plate. The program welding electrode is MIL-E-19822. A 20 deg V-joint will serve as the initial configuration for laser filler wire welding. Work will be accomplished with a 10.6 micron beam from a 15 kW CO2 laser. GRA

N80-11474# Brunswick Corp., Deland, Fla. Technetics Div.
DEVELOPMENT OF IMPROVED ABRADABLE COMPRESSOR GAS PATH SEAL Final Report, 20 Sep. 1976 - 19 May 1978
W. P. Jarvi and A. R. Erickson Jul. 1978 140 p
(Contract F33615-76-C-5302; AF Proj. 7312)
(AD-A072171; ER-382; AFML-TR-78-101) Avail: NTIS HC A07/MF A01 CSCL 21/5

A number of fiber metal systems were evaluated by rig testing in comparison with the base line material, FM-521 - a 19% dense, Haynes 188, 8 micron fiber metal - which is the standard production material used for the highest temperature compressor blade tip seals in the P and WA F-100 engine. A range of densities and strengths of alternative materials were evaluated including Haynes 188, FeCrAlY, NiCrAlY, and FeNiCrAlY employing fiber diameters in the range of 8 - 23 microns with fiber aspect ratios in the range of 45 - 80. Rig tests employed were high speed rub testing, cyclic static oxidation, cyclic dynamic oxidation, and hot particulate erosion. These data were supplemented with measurements of mechanical, thermal, and chemical properties. The best material tested was a 20.5% dense FeNiCrAlY fiber metal employing 17 micron fibers. This had at least equivalent abradability and improved oxidation and erosion resistance in comparison with the base line material. GRA

N80-11475# Naval Ordnance Station, Louisville, Ky. Manufacturing Technology Dept.
EXPLOSIVE FORMING OF BUTT WELDED PIPE REDUCERS Final Report
Michael W. Johnson Apr. 1979 60 p
(AD-A072430; NOSL-MT-052) Avail: NTIS HC A04/MF A01 CSCL 13/11

This program was conducted to develop a method of explosively forming butt-welded pipe reducers. Forming trials were conducted in both carbon steel and 70-30 copper-nickel material. A chart showing the various sizes of reducers that can be formed via this process, and listing the explosive charge size required, is included. Results of burst tests performed on explosively-formed reducers are reported. GRA

N80-11476# Bendix Corp., Kansas City, Mo.
HOBBING RATCHET WHEELS FOR MINIATURE MECHANISMS
R. B. Wetherill and L. K. Gillespie Dec. 1978 24 p refs

Revised
(Contract EY-76-C-04-0613)
(BDX-613-1927-Rev) Avail: NTIS HC A02/MF A01

A study of hobbing as a production technique is presented. This indicated that for many configurations it is a more economical approach than traditional methods. A technique for determining ratchet shapes applicable to hobbing is defined. DOE

N80-11477# Oak Ridge Y-12 Plant, Tenn.
ELECTRON-BEAM BRAZE WELDING OF BERYLLIUM
M. A. Perkins 19 Sep. 1978 28 p refs
(Contract W-7405-eng-26)
(Y-2138) Avail: NTIS HC A03/MF A01

Electron beam braze welds were made in beryllium by using less than the recommended amount of aluminum filler metal. The welds exhibited a tendency to form microcracks prior to the termination of solidification; however, these microcracks were healed by the backfilling action of the aluminum/beryllium eutectic present in the fusion zone. Adverse effects attributable to the prior microcracking condition were not found. DOE

N80-11478# Sandia Labs., Albuquerque, N. Mex. Process Metallurgy Div.
EFFECT OF SURFACE CONTAMINATION OF SOLID PHASE WELDING: AN OVERVIEW
J. L. Jellison 1978 26 p refs Presented at Symp. on Surface Contamination, Hamilton, Ontario, 2 Jun. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0223C; Conf-7806124-1) Avail: NTIS HC A03/MF A01

Surface contaminants which hinder solid phase welding by not allowing metallic surfaces to be brought sufficiently close together so that short range interatomic attractive forces operate are investigated. The effect of surface contamination on solid phase welding due to surface metallic atoms forming bonds with contaminant atoms and thus reducing attractive forces is discussed. The detrimental effect of organic contaminants on deformation welding is examined along with the effect of inorganic films on diffusion welding. DOE

N80-11479# Bari Univ. (Italy). Ist. di Macchine.
OFF-DESIGN PERFORMANCE PREDICTION OF RADIAL INFLOW TURBINES. VOLUME 2
Francesco Casalini and Andrea Dadone 1978 25 p refs In ITALIAN; ENGLISH summary Presented at 33d Natl. Assoc. Termotec. Ital. (ATI) Congr., Ancona, Italy, 5-8 Sep. 1978
(Contract CNR-77-01088.07)
Avail: NTIS HC A02/MF A01

Two theoretical methods apt to estimate the off-design performances of small-size radial inflow turbines are outlined. A modification of one of the two methods is suggested which allows for evaluating nozzle and rotor velocity coefficients as well as disk friction losses. Theoretical results are compared with experimental ones reported in the literature; the modified method gives theoretical predictions which are more reliable and in good agreement with experimental ones. Author (ESA)

N80-11480# Uppsala Univ. (Sweden). Inst. of Technology.
METALLIC WEAR PARTICLES: A SHORT REVIEW
Jose Rendon Feb. 1978 19 p refs
(UPTEC-78-11-R) Avail: NTIS HC A02/MF A01

A classification of various metal surface wear particles according to shape as well as type of wear formation is presented. The different wear mechanisms involved, such as rubbing wear, cutting wear, surface fatigue wear, and corrosion wear, are discussed and related to the physical characteristics of the wear particles they produce. The discussion is supported by micrographs taken with a scanning electron microscope. Finally, methods for recovering wear particles for quantitative analysis of machine parts wear are briefly described and the analysis of wear particles as a way of understanding wear is considered. Author (ESA)

N80-11481# Uppsala Univ. (Sweden). Inst. of Technology.
STUDIES OF ABRASIVE WEAR IN A MODIFIED IMPACT TESTING MACHINE
Ulf Bryggman, Sture Hogmark, and Olof Vingsbo Sep. 1976 32 p refs
(UPTEC-78-79-R) Avail: NTIS HC A03/MF A01

Single tip abrasive wear was simulated in a conventional impact test machine modified by attaching a cemented carbide tip radially to the hammer. The swinging hammer produced a groove in the horizontal surface of low carbon steel of specimens, supported by a specially designed holder. Microstructure studies, using optical microscopy, scanning electron microscopy, and transmission electron microscopy, reveal the formation of successive layers of different structures, which are related to measured variations in microhardness under the groove bottom surface. Also, repeated grooving in the same track was performed in order to simulate normal abrasion. The energy consumed during grooving is given by the loss of potential energy of the pendulum and was read with the aid of the standard equipment of the impact tester. It proved possible to obtain a significant differentiation between the steels to consumed grooving energy. Author (ESA)

N80-11482# Bari Univ. (Italy). Ist. di Macchine.
A COMPARISON OF FIVE METHODS FOR CALCULATING THE EXHAUST FLOW FROM INTERNAL COMBUSTION ENGINES [CONFRONTO TRA CINQUE METODI DI CALCOLO DEI CONDOTTI DI SCARICO DEI MOTORI ALTERNATIVI]
Andrea Dadone and Francesco Varrese Apr. 1978 35 p refs In ITALIAN; ENGLISH summary
(Contract CNR-76-00771.07)
Avail: NTIS HC A03/MF A01

A Euler equations method, a conservation equations method, Ferrai-Toti's method, the Goyal-Scharpf-Borman Method, and the Issa-Spalding method were compared in terms of their application to the integration of the differential equations pertaining to the one dimensional unsteady flow in internal combustion engine exhaust systems. Theoretical results were compared with experimental ones, reported in the literature, obtained with a one cylinder engine exhaust system. The comparison involved varying the mesh number. The Euler equations method gives the best results, but Ferrari-Toti's method and the conservation equations method are also satisfactory. On the contrary, the Goyal-Scharpf-Borman method requires too much computation time and the Issa-Spalding method results are unsatisfactory. Author (ESA)

N80-11483# Bari Univ. (Italy). Ist. di Macchine.
EXHAUST FLOW SIMULATION FO A ONE CYLINDER ENGINE WITH A DIVERGENT EXHAUST PIPE
Andrea Dadone Mar. 1978 20 p refs In ITALIAN; ENGLISH summary
(Contract CNR-77-01088.07)
Avail: NTIS HC A02/MF A01

A single cylinder engine model is considered together with its exhaust system consisting of a straight pipe followed by a divergent one. A particular set of equations describing the flow at the interior of the exhaust system is outlined and a form of artificial viscosity is suggested which allows the integration of flow equations overcoming the occurrence of numerical oscillations. Theoretical results obtained by means of an electronic computer program fairly agree with experimental ones reported in the literature. Author (ESA)

N80-11484# Bari Univ. (Italy). Ist. di Costruzioni di Macchine.
STRUCTURAL ANALYSIS OF A 15.000 TONS 'O' PRESS
Bruno Atzori, Franco Fresa, and Oronzo Giordano (Italsider) 1978 21 p refs
Avail: NTIS HC A02/MF A01

The stresses related to a 15,000 ton 'O' press under working conditions were analyzed using a modified version of the computer program STRUDL 2. Results were compared with experimental values obtained by strain gage measurements. Several mathematical models were considered in order to determine the effects of load distribution and the idealization of external constraints. The accuracy of the results given by the different models was examined in terms of the structural analysis performed, taking into account its associated difficulties. The good agreement between numerical and experimental results confirms the effectiveness of STRUDL 2 in studying complex mechanical structures. Author (ESA)

N80-11485# Bari Univ. (Italy). Ist. di Macchine.
ON THE OFF-DESIGN PERFORMANCE OF SMALL RADIAL TURBINES
Francesco Casalini and Andrea Dadone May 1978 39 p refs In ITALIAN; ENGLISH summary
(Contract CNR-77-01088.07)
Avail: NTIS HC A03/MF A01

Two theoretical methods apt to estimate the off-design performances of small size radial flow turbines are outlined. A modification of one of the two methods is suggested which makes it possible to evaluate nozzle and rotor velocity coefficients as well as disk friction losses. Theoretical results were obtained for the two methods. A comparison was also carried out with experimental results reported in the literature, pertaining to four different radial turbines. The second modified method gives theoretical predictions which are more reliable and in good agreement with experimental results. Author (ESA)

N80-11486# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.
ONE DIMENSIONAL DESIGN OF CENTRIFUGAL COMPRESSORS TAKING INTO ACCOUNT FLOW SEPARATION IN THE IMPELLER
P. Frigne (Navorsingstagiair Van Het I. W. O. N. L) and R. vandenBraembussche Jun. 1979 107 p refs
(VKI-TN-129) Avail: NTIS HC A06/MF A01

A one dimensional computation method for the design of a centrifugal compressor which takes into account various real flow effects, such as flow separation in the impeller, jet-wake mixing in the vaneless space, transonic vaned diffuser performance, and diffuser outlet dump diffusion, is discussed. Several numerical examples are worked out in detail to show the influence of different important geometrical and aerodynamical parameters on the compressor performances. This approach is the one used for the VKI computer program COMRAD. The equations used in the program are elucidated. Author (ESA)

N80-11487# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
RANKING TIRES USING A TRANSIENT SPEED-TIME CYCLE
Richard N. Burgeson Mar. 1979 19 p refs
(PB-297756/9; SDSB-79/14) Avail: NTIS HC A02/MF A01 CSCL 13F

The ability to rank passenger car tires according to their respective rolling resistance facilitates emission and fuel economy testing and can serve as a consumer buying aid. However, at the present time a single, universally accepted tire rolling resistance measurement method is not available. Current practices measure rolling resistance while the tire operated at steady state conditions which are a typical of actual tire use. Emission Control Technology Division is concerned that tires ranked according to typical steady state practices perform differently when operated according to current emissions and fuel economy (transient) tests or in real life. This study was conducted to determine the difference in tire rolling resistance rankings from steady state and transient testing. GRA

N80-11488# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
COMPUTER SIMULATION OF TIRE SLIP ON A CLAYTON TWIN ROLL DYNAMOMETER
John Yurko Feb. 1979 15 p refs
(PB-297764/3; SDSB-79-10) Avail: NTIS HC A02/MF A01 CSCL 13F

The occurrence of tire slip on a twin roll dynamometer, due to the difference in the velocities of the front and rear rolls of the dynamometer is examined. The slip is modeled by a method previously described and the results are presented. A computation of the total energy effect due to the tire slip is discussed. A.W.H.

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-11489# Army Tropic Test Center APO, Miami 34004.
MATERIEL TESTING IN THE TROPICS
Apr. 1979 274 p refs
(AD-A072434; USATTC-790401) Avail: NTIS HC A12/MF A01 CSCL 14/2

Practically every materiel development effort and subsequent procurement of materiel for Army use must undergo developmental testing to ensure that specified performance criteria are met in a variety of climatic categories. It is thus, highly desirable to have ready access to a document that is an update of available information in terms of appropriate environmental descriptions, and their known and perceived effects on man and materiel as an aid in planning and executing effective environmental tests. The objective of Materiel Testing in the Tropics is to meet such needs by periodically updating information pertinent to testing materiel in the humid tropics. The report is a compendium of the US Army's experiences and available literature in testing materiel in the humid tropics, and special investigations conducted by USATTC to better understand the effects of the environment on the performance of man and materiel. Topics include the need for tropic testing, an environmental description of the Panama Canal Zone, degrading environmental factors, tropic degradation of selected materials and materiel, materiel reliability and maintainability, and effects of the jungle on man and materiel. This document should provide valuable information for those who design, evaluate or use equipment in the humid tropics. GRA

N80-11490# California Univ., Davis. Dept. of Mathematics.
BATHTUB AND RELATED FAILURE RATE CHARACTERIZATIONS Interim Report
Ronald E. Glaser Sep. 1978 31 p refs
(Grant AF-AFOSR-3180-77; AF Proj. 2304)
(AD-A072626; TR-8; AFOSR-78-1440TR) Avail: NTIS HC A03/MF A01

Sufficient conditions are obtained which provide that a lifetime density has a bathtub shaped failure rate. Analogous conditions handle increasing, decreasing, and upside-down bathtub shaped failure rates. Application of these results to exponential families of densities is particularly straight forward and effective. Examples are furnished which introduce new bathtub models and illustrate the use of the general results for existing models. Examples involving mixtures are considered. Maximum likelihood estimation for one of the bathtub models is described. GRA

N80-11491# Missouri Univ. - Columbia. Dept. of Statistics.
A BAYESIAN NONPARAMETRIC APPROACH TO RELIABILITY
Richard L. Dykstra and Purushottam Laud 10 Jul. 1979 43 p refs
(Contract N00014-78-C-0655)
(AD-A072431; TR-84) Avail: NTIS HC A03/MF A01 CSCL 12/1

It is suggested that problems in a reliability context may be handled by a Bayesian non-parametric approach. A stochastic process is defined whose sample paths may be assumed to be either increasing hazard rates or decreasing hazard rates by properly choosing the parameter functions of the process. The posterior distribution of the hazard rates are derived for both exact and censored data. Bayes estimates of hazard rates, c.d.f.'s, densities, and means, are found under squared error type loss functions. Some simulation is done and estimates graphed to better understand the estimators. Finally, estimates of the c.d.f. from some data in a paper by Kaplan and Meier are constructed. GRA

N80-11492# Polytechnic Inst. of New York, Brooklyn. Dept. of Mathematics.
RENEWAL MODEL OF RELIABILITY FOR SERIES SYSTEMS - REVISITED
Leon H. Herbach, J. Arthur Greenwood (Oceanweather, Inc., White Plains, N. Y.), and Saul B. Blumenthal (Kentucky Univ., Lexington)

29 Jun. 1979 88 p refs
(Contract N00014-77-C-0601; NR Proj. 042-377)
(AD-A072401; POLY/MA-79-3) Avail: NTIS
HC A05/MF A01 CSCL 12/1

The fact that failures follow the exponential distribution is almost universally accepted in reliability analysis. Two reasons are given for this assumption: (1) It is commonly assumed that electronic components do not wear out but are subject to random shocks which may cause failure. If these shocks form a Poisson process the underlying failure distribution is exponential. (2) Sufficiently complex equipment run for a long time (failed components being replaced by good ones) will follow the exponential distribution. These reasons are investigated. GRA

N80-11493# Stanford Univ., Calif.

RELIABILITY PREDICTION FOR MECHANICAL SYSTEMS

Final Report, 20 Apr. 1978 - 19 Apr. 1979

M. Vernon Johns, Jr. 11 Jul. 1979 10 p refs
(Grant DAAG29-78-G-0213)
(AD-A071835; ARO-13859.3-MX) Avail: NTIS
HC A02/MF A01 CSCL 14/4

Two areas were investigated. A method for producing exact confidence bounds for the reliability of highly reliable series systems is considered. The methods are based on finding suitable orderings of the sample outcome space, and are valid when the probabilities of component failure are small enough for the failure data to be distributed as Poisson random variables. Optimality criteria are invoked to insure that the orderings used produce confidence bounds which are as tight as possible. Tables to facilitate applications were produced. A new class of robust estimators of location were studied. These estimators (called P-estimators) are analogous to Pitman estimators in the same way that M-estimators are analogous to maximum likelihood estimators. Members of this class were evaluated by computer simulation and were found to perform with even higher efficiency than the bisquare M-estimator for both long and short tailed distributions. GRA

N80-11494# *Florida State Univ., Tallahassee. Dept. of* Statistics.

ACCELERATED LIFE TESTING: A PRAGMATIC BAYESIAN APPROACH Interim Report

Frank Proschan and Nozer D. Singpurwalla Jul. 1978 24 p refs
(Contract N00014-77-C-0263; AF-AFOSR-2581-74; AF Proj. 2304)
(AD-A072622; FSU-Statistics-M474) Avail: NTIS
HC A02/MF A01 CSCL 12/1

In this paper we propose a model for accelerated life testing which differs from those considered in the past. Our model does not require the usual assumptions about the failure distributions and the acceleration functions. Our approach is Bayesian, and depends on the estimation of ordered failure rate functions at different stress levels. Since our model is nonprametric, and our approach is quite pragmatic, our results should be of use to engineers working on accelerated life tests, and biometricians involved in carcinogenic experiments. GRA

N80-11495# Rockwell International Corp., Thousand Oaks, Calif. Science Center.

A COMPUTATIONAL MODEL FOR THREE-DIMENSIONAL INCOMPRESSIBLE WALL JETS WITH LARGE CROSS FLOW

Final Report, 19 Sep. 1977 - 18 Sep. 1978

W. D. Murray, V. Shankar, and N. Malmuth Sep. 1978 117 p refs
(Contract N62269-77-C-0412; RR0230221)
(AD-A071689; SC5129.5FR; NADC-77163-30) Avail: NTIS
HC A06/MF A01 CSCL 20/4

The flow field of three dimensional incompressible wall jets prototypic of thrust augmenting ejectors with large cross flow is solved using a very efficient centered-Euler scheme in an orthogonal curvilinear coordinate system. The computational model treats initial conditions with arbitrary velocity profiles at or downstream of the jet exit. An averaging approach is employed for the first few marching steps to overcome spurious numerical oscillations associated with arbitrary initial profiles. Laminar as well as turbulent wall jets are simulated. Turbulence is introduced using a two layer mixing length model appropriate to curved three-dimensional wall jets. Typical results quantifying jet spreading, jet growth, nominal separation and jet shrink effects due to cross flow are presented. GRA

N80-11496# Adaptronics, Inc., McLean, Va.

EXPLORATORY DEVELOPMENT OF ADHESIVE BAND FLAW DETECTION Final Report, 1 Apr. 1978 - 30 Nov. 1978

Murray H. Loew, James M. Fitzgerald, Anthony N. Mucciardi, Richard E. Elsley, and George A. Alers Dec. 1978 136 p refs Sponsored in part by Rockwell International Science Center
(Contract F33615-78-C-5079; AF Proj. 7351)
(AD-A072724; AFML-TR-78-206) Avail: NTIS
HC A07/MF A01 CSCL 14/2

This project sought to establish the feasibility of automatic detection and classification of bond line defects in multiple-layer adhesively bonded structures. Bond strength was not the issue in this work; rather, the detection and classification of a bond line flaw per layer into one of three classes- unbond, void, porosity-independent of part geometry was the main objective. Each part was scanned from one flat surface using a 0.5 inch transducer in the pulse-echo mode. A decision was rendered automatically regarding the existence and classification of defects in each layer for each pulse-echo return in an overall scan pattern. Results show that flaws in multiple-layer structures can be found with accuracies of 91% as to defect versus non-defect discrimination, and 92% as to the correct type of defect. In this work, a false-alarm rate of 19% (non-defects called defects) and a false dismissal rate of 2% (defects called non-defects) was obtained. It is believed that the false alarm rate could be greatly reduced by use of multiple-point(contextual) information from contiguous scans. It has been shown that it is feasible and practical to use ultrasound to detect and classify defects and flaws in multiple-layer adhesively bonded structures, regardless of the layers in which they lie. The method is, by design, insensitive to moderate variations in transducer orientation and to construction geometry. The accuracies on a blind evaluation test compare very well with the data used to train the ALN classifier system. GRA

N80-11497# Hanford Engineering Development Lab., Richland, Wash.

EXPERIMENTAL ELECTRO-THERMAL METHOD FOR NONDESTRUCTIVELY TESTING WELDS IN STAINLESS STEEL PIPES

D. R. Green 19 Jan. 1979 29 p refs Presented at Natl. Am. Soc. for Nondestructive Testing Conf., San Diego, Calif., 2 Mar. 1979
(Contract EY-76-C-14-2170)
(HEDL-SA-1705; Conf-790366-1) Avail: NTIS
HC A03/MF A01

Electrothermal nondestructive testing of welds in austenitic stainless steel pipes is examined. The development of contacts for injecting the electrothermal exciting current into asreceived stainless steel pipe weld specimens without contaminating or damaging the surface is discussed. The electrothermal method's potential applicability to stainless steel welds of the type used in fast flux test facility pipes is investigated. A.W.H.

N80-11498# *Danish Research Center for Applied Electronics, Hoersholm.*

SYSTEM RELIABILITY AND COMPONENT COSTS. A CORRELATION OF COMPONENT QUALITY, FAILURE RATE, AND REDUNDACY PARAMETERS [SYSTEMP-AALIDELIGHED OF KOMPONENTOMKOSTNINGER. BETRAGTNINGER OVER SAMSPILLET MELLEM PAALIDELIGHED OF KOMPONENTOMKOSTNINGER FOR ET ELEKTRONISK SYSTEM. HOVEDPARAMETRENE ER KOMPONENTKVALITET, -BELASTNINGSGRAD OG REDUNDANS]

Joergen Biegel Feb. 1978 34 p refs In DANISH; ENGLISH summary
(ECR-79) Avail: NTIS HC A03/MF A01

System reliability was correlated to component costs using as main parameters the component quality, the component failure rate, and redundancy in order to optimize the relationship. The reliability, costs, and the relationship quality/cost was studied for each of the three parameters. It is concluded that if a short

term period is considered, redundancy shows a better ratio reliability/cost, while at medium and long term, high quality components are preferred. Author (ESA)

N80-11499# Uppsala Univ. (Sweden). Dept. of Automatic Control and Systems Analysis.

COMPARISON OF SOME INSTRUMENTAL VARIABLE METHODS: CONSISTENCY AND ACCURACY ASPECTS

T. Soederstroem and P. Stoica (Inst. Politec. Bucharest) Oct. 1978 58 p refs

(UPTEC-7Z-88-R) Avail: NTIS HC A04/MF A01

A general analysis of various instrumental variable methods is given. The investigation includes methods for open loop operation as well as methods designed for closed loop operation. The instrumental variables are formed as different combinations of inputs, delayed outputs, filtered inputs, and external set point variations. Comparison is also made with prediction error methods. Necessary conditions as well as sufficient conditions for consistency are explicitly derived and discussed. Some simple counter-examples to general consistency for some common instrumental variable methods are also included: asymptotic accuracy properties are then reviewed. Finally, examples show how the use of filters will influence the covariance matrix of the parameter estimates. Author (ESA)

N80-11500# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.

DEVELOPMENT OF THE STATISTICAL PATTERN RECOGNITION METHODOLOGY AND ITS APPLICATION TO QUALITY CONTROL

Josef Kittler Sep. 1978 145 p refs Sponsored by Roy. Soc.

(ENST-D-78023) Avail: NTIS HC A07/MF A01

Various aspects of statistical pattern recognition are reviewed. In the area of feature selection, feature set search algorithms for selecting a subset of pattern descriptors from a set of measurements are comparatively studied. Decision making systems are then considered, particularly as regards measurement errors and the subsequent increase in the error probability of the system. In the realm of pattern classification, the problem of designing a pattern recognition system for processing incomplete pattern vectors is discussed. Next, it is shown that the probability distribution of empirical error count estimate is not binomial and a recursive formula for determining this distribution is given. Finally, pattern recognition techniques are applied to the problem of automatic inspection of products by lots. Alternative approaches to acceptance sampling plan design are proposed. Author (ESA)

N80-11501# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.

SOFTWARE AND PROCEDURES FOR STATISTICAL QUALITY CONTROL [LOGICIELS ET PROCEDURES DE CONTROLE STATISTIQUE DE RECEPTION]

L. F. Pau, M. Deglaire, J. Kittler, M. Thongsa, and C. Toghraie Apr. 1979 171 p refs Partly in FRENCH and ENGLISH

(Contracts ENST-292261; LCIE-292958)

(ENST-D-79006) Avail: NTIS HC A08/MF A01

A number of acceptance sampling procedures for statistical quality control, most of which involve measurements, together with the software packages developed for the corresponding sampling plan computations are introduced. The procedures include finite lot acceptance sampling by attributes, without or with individual classification errors; acceptance sampling by measurements with two-sided control of the mean; nonparametric sequential control by measurements; Bayesian acceptance sampling of the mean; and statistical control of the percentage defective determined from multivariate measurements on each item in the sample. A complete theoretical description and an example of computer implementation are given for each procedure presented. Author (ESA)

N80-11502*# National Bureau of Standards, Washington, D.C. Center for Materials Sciences.

PROCEEDINGS OF THE 28TH MEETING OF THE MECHANICAL PREVENTION GROUP, REPORT ON MFPG DETECTION, DIAGNOSIS, AND PROGNOSIS

T. Robert Shives and William A. Willard Jul. 1979 371 p Meeting held at San Antonio, Tex., 28-30 1978 Sponsored in part by Office of Naval Res., Arlington, Va., and DOE, Wash., D. C.

(NASA-TM-80881; PB-297399/8; NBS-SP-547; LC-79-600078) Avail: NTIS HC A16/MF A01 CSCL 14B

These proceedings consist of a group of twenty five papers dealing with detection, diagnosis, and prognosis as related to mechanical failure prevention. Special emphasis is on aerospace applications, land based applications, marine applications, and industrial application. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-11503# Verlag Stahleisen m.b.H., Duesseldorf (West Germany).

BEHAVIOUR OF STEEL UNDER CYCLIC LOADING

Winfried Dahl 1978 337 p refs In GERMAN Presented at Werkstoffkunde, Eisen und Stahl 3, 1977

(ICAF-1090) Avail: NTIS HC A15/MF A01

The report contains 20 papers covering the following subjects, preferably demonstrated for steels: testing technology, plastic yielding and fracture behaviour, crack initiation, crack propagation, influence of texture, manufacture, loading conditions, internal stresses and notches on the cyclic behaviour, application of fracture mechanics, description of measured load-time histories, simulations on load-time-histories in fatigue tests, influence of the material on fatigue, fatigue life prediction methods, corrosion and endurance limit, cyclic loading at high temperature, low cycle fatigue at room temperature and fatigue of welded joints. A.R.H.

N80-11504# Royal Aircraft Establishment, Farnborough (England).

ANALYSIS AND SYNTHESIS OF OPERATIONAL LOADS

J. H. Argyris, W. Aicher, and H. J. Ertelt May 1979 85 p refs Transl. into ENGLISH of "Analyse und Synthese von Betriebsbelastungen", ISD Rept. 193 Univ. of Stuttgart, 1976 (RAE-Lib-Trans-2008; BR70163; ISD-Rept-193) Avail: NTIS HC A05/MF A01

A method for the analysis of the operational loads on light structures is investigated. The representation of the specified theoretical value, in servohydraulic loading devices, in the form of a Markov matrix of the transition probabilities, is the method examined. The suitability of the method for the analysis and synthesis of operational loads is discussed. The advantages of data reduction and plotting over previous methods for the control of fatigue tests are described and the accuracy of the method in dynamic loading in tests is reported. An analysis and synthesis of an operational load is presented. A.W.H.

N80-11505*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

LIGHT AIRPLANE CRASH TESTS AT THREE PITCH ANGLES

Victor L. Vaughan, Jr. and Emilio Alfaro-Bou Nov. 1979 62 p refs

(NASA-TP-1481) Avail: NTIS HC A04/MF A01 CSCL 01C

Three similar twin-engine general aviation airplane specimens were crash tested at an impact dynamics research facility at 27 m/sec, a flight path angle of -15 deg, and pitch angles of -15 deg, 0 deg, and 15 deg. Other crash parameters were held constant. The test facility, instrumentation, test specimens, and test method are briefly described. Structural damage and accelerometer data for each of the three impact conditions are presented and discussed. Author

N80-11506*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

STATISTICAL ENERGY ANALYSIS RESPONSE PREDICTION METHODS FOR STRUCTURAL SYSTEMS Final Report, 25 Sep. 1978 - 25 Sep. 1979

R. F. Davis Oct. 1979 107 p refs
(Contract NAS8-33191)
(NASA-CR-161334; MDC-G8150) Avail: NTIS HC A06/MF A01 CSCL 20K

The results of an effort to document methods for accomplishing response predictions for commonly encountered aerospace structural configurations is presented. Application of these methods to specified aerospace structure to provide sample analyses is included. An applications manual, with the structural analyses appended as example problems is given. Comparisons of the response predictions with measured data are provided for three of the example problems. R.C.T.

N80-11507# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.

DISCONTINUOUS DEFORMATION GRADIENTS IN THE FINITE TWISTING OF AN INCOMPRESSIBLE ELASTIC TUBE

Rohan C. Abeyaratne Jun. 1979 77 p refs
(Contract N00014-75-C-0196)
(AD-A071728; TR-42) Avail: NTIS HC A05/MF A01 CSCL 20/11

It is known that the type of the system of partial differential equations governing finite elastostatics can change from elliptic to non-elliptic at sufficiently large deformations for certain materials. This introduces the possibility that the elastostatic field may exhibit certain discontinuities. In this paper we illustrate the occurrence of elastostatic fields with discontinuous deformation gradients in a physical problem. The body is assumed to be composed of a material which belongs to a particular class of isotropic, incompressible, elastic materials which allow for a loss of ellipticity. It is shown that no solution which is smooth in the classical sense exists to this problem for certain ranges of the applied loading. Next, we admit solutions involving elastostatic shocks into the discussion and find that the problem may then be solved completely. When this is done, however, there results a lack of uniqueness of solutions to the boundary-value problem. In order to resolve this non-uniqueness, the dissipativity and stability of the solutions are investigated. GRA

N80-11508# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

A MULTILAYER TRACTION-FREE EDGE, QUADRILATERAL, WARPING ELEMENT FOR THE STRESS ANALYSIS OF COMPOSITE PLATES AND SHELLS Final Report, 1 Mar. 1978 - 30 Apr. 1979

Alexander Harris, Oscar Orringer, and Emmett A. Witmer Apr. 1979 241 p refs
(Contract DAAG46-78-C-0015)
(AD-A071910; ASRL-TR-193-1) Copyright. Avail: NTIS HC A11/MF A01 CSCL 20/11

A hybrid stress multilayer warping quadrilateral element with a traction-free edge (TFQE), based on the Principle of Modified Complementary Energy, has been developed for efficient finite element modeling and analysis at and near free edges. The assumed stress distributions in the element were selected so as to satisfy the basic equations of equilibrium; sufficient detail was implemented throughout each layer of each element to model the steep boundary layer stress gradients, including the important interlaminar stresses. The interlayer stress continuity and traction-free conditions at the free edge are satisfied exactly; the resulting stress distribution was examined for consistency as required by 3-dimensional stress functions. The stress assumption includes no singularity. The traction-free edge is allowed to warp freely. GRA

N80-11509# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.

LARGE DEFORMATION ELASTIC-PLASTIC BUCKLING ANALYSIS OF SPHERICAL CAPS WITH INITIAL IMPERFECTIONS

Robert Kao May 1979 53 p refs
(Contract N00014-75-C-0944S)
(AD-A071480) Avail: NTIS HC A04/MF A01 CSCL 20/11

Large deformation elastic-plastic buckling loads are obtained for axisymmetric spherical caps with initial imperfections. The problem formulation is based on equilibrium equations in which the plastic deformation is taken as effective plastic loads. Plasticity theory is derived from von Mises initial yield condition and Prager-Ziegler kinematic hardening rule. Results show that both initial imperfection and plastic deformation have the same effect of reducing buckling loads, and that the influence of plastic yielding diminishes as the magnitude of imperfections increases. GRA

N80-11510# PMB Systems Engineering, Inc., San Francisco, Calif.

FAILURE CRITERIA FOR REINFORCED CONCRETE STRUCTURES. VOLUME 1: LITERATURE SURVEY AND PROPOSED ANALYTICAL MODELS Final Report

Richard W. Litton and Jawahar M. Gidwani May 1979 123 p refs
(Contract F29601-76-C-0135)
(AD-A070643; AFWL-TR-77-239-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 11/2

This literature summary reviews experimental and analytical studies relevant to the Theoretical Investigation of Failure Criteria for Reinforced Concrete Structures. An extensive list of relevant references used in this survey is also presented. GRA

N80-11511# PMB Systems Engineering, Inc., San Francisco, Calif.

FAILURE CRITERIA FOR REINFORCED CONCRETE STRUCTURES. VOLUME 2: ANALYTICAL MODEL AND RESPONSE DATA Final Report

Richard W. Litton and Jawahar M. Gidwani May 1979 266 p
(Contract F29601-76-C-0135)
(AD-A070644; AFWL-TR-77-239-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 11/2

Failure criteria defining complete loss of section strength for reinforced concrete sections are defined in this Volume II of the report. Failure envelopes obtained from a three-dimensional finite element analysis with a three dimensional nonlinear constitutive material model are presented in terms of deformations for various rectangular and cylindrical sections. Applications and examples of the use of these failure envelopes are also presented. GRA

N80-11512# Northrop Corp., Hawthorne, Calif. Aircraft Group.

EFFECT OF MULTIAXIAL LOADING ON CRACK GROWTH. VOLUME 3: COMPILATION OF INTERFEROMETRY PHOTOGRAPHS Final Report, 15 Sep. 1976 - 15 Sep. 1978

A. F. Liu and D. F. Dittmer Dec. 1978 185 p
(Contract F33615-76-C-3121; AF Proj. 486U)
(AD-A072074; NOR-78-161-Vol-3; AFFDL-TR-78-175) Avail: NTIS HC A09/MF A01 CSCL 20/11

An exploratory research program has been conducted to systematically evaluate the effects of biaxial stress ratio on constant amplitude and variable amplitude fatigue crack growth rates. A series of experiments and analyses have been carried out on the cyclic crack growth behavior of center-cracked cruciform specimens under various biaxial loading conditions. GRA

N80-11513# Northrop Corp., Hawthorne, Calif. Aircraft Group.

EFFECT OF MULTIAXIAL LOADING ON CRACK GROWTH. VOLUME 1: TECHNICAL SUMMARY Final Report, 15 Sep. 1976 - 15 Sep. 1978

A. F. Liu and D. F. Dittmer Dec. 1978 238 p refs
(Contract F33615-76-C-3121; AF Proj. 486U)
(AD-A072122; NOR-78-161-Vol-1; AFFDL-TR-78-175-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 20/11

An exploratory research program has been conducted to systematically evaluate the effects of biaxial stress ratio on constant amplitude and variable amplitude fatigue crack growth rates. A series of experiments and analyses have been carried out on the cyclic crack growth behavior of center-cracked cruciform specimens under various biaxial loading conditions. The results may be summarized as follows. Cracks will grow straight in a biaxial stress field when the stress component parallel to the crack is equal to or smaller than the stress component normal to the crack. Elastic K factors are obtainable for both straight and curved cracks and are adequate for correlating the biaxial growth rate data. At a given stress intensity level, the constant

amplitude crack growth rates are the same in all the biaxial loading conditions. In out-of-phase loading conditions, the crack growth rate and crack growth directions are the same as those in the in-phase loading conditions. Crack tip plastic zone size variations with biaxial ratio appeared to have no effect on constant-amplitude crack growth rate. As for the variable amplitude tests, it is very evident that cracks grow faster at positive biaxial stress states, but slower at negative biaxial loading conditions. GRA

N80-11514# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
NONLINEAR DYNAMIC BUCKLING OF SPHERICAL CAPS WITH INITIAL IMPERFECTIONS
Robert Kao Jun. 1979 53 p refs
(Contract N00014-75-C-0946)
(AD-A071450) Avail: NTIS HC A04/MF A01 CSCL 20/11

A finite difference method is developed for large deformation elastic-plastic dynamic buckling analysis of imperfect spherical caps. The problem formulation is based on governing equations of motion, treating plastic deformation as effective plastic loads. Plasticity theory is derived from von Mises yield condition and Prager-Ziegler kinematic hardening rule which predicts an ideal Bauschinger effect. Results indicate that dynamic effect has the influence of reducing load carrying capacity of perfect spherical caps; however, its influence on imperfect caps depends on the magnitude of initial imperfections. GRA

N80-11515# California Univ., Livermore. Lawrence Livermore Lab.
STRESS-RUPTURE LIFE OF KEVLAR/EPOXY SPHERICAL PRESSURE VESSELS
R. E. Barlow, R. H. Toland, and T. Freeman 23 Feb. 1979 62 p refs
(Contract W-7405-eng-48)
(UCID-17755-Pt-3) Avail: NTIS HC A04/MF A01

This study of stress rupture has two objectives: to generate baseline data on vessel life under pressure and to apply statistical reliability theory to vessel and strand data in order to predict reliability at given stress levels. The improved life prediction methods useful in the analysis of life data are described. These methods are applied to two sets of data, i.e., the extensive Kevlar/epoxy strand data and the current Kevlar/epoxy spherical pressure vessel data. Of principal importance is the observation that the hazard rates for both data sets are time-dependent at low stress levels; as a result, the exponential lifetime distribution is not valid. Plans are discussed for accelerated life-tests of pre-production units, methods for choosing sample sizes, and in-service replacement policies. DOE

N80-11516# California Univ., Livermore. Lawrence Livermore Lab.
ON-LINE STRUCTURAL RESPONSE ANALYSIS: USING THE EXTENDED KALMAN ESTIMATOR/IDENTIFIER
J. V. Candy 5 May 1979 68 p refs
(Contract W-7405-eng-48)
(UCID-18175) Avail: NTIS HC A04/MF A01

The development of on line state and parameter estimators used to analyze the structural response of buildings is discussed. The estimator/identifier, an extended Kalman filter (EKF), is described. The EKF performance on simulated noisy structural response data is determined. DOE

N80-11517# Foster Wheeler Corp., Livingston, N.J.
ELASTIC-PLASTIC-CREEP ANALYSIS OF SHELLS
D. H. Dai 1979 23 p refs Presented at Computational Methods in Nuclear Engineering, Williamsburg, Va., 23 Apr. 1979
(Contract EW-76-C-2395)
(CONF-790402-16) Avail: NTIS HC A02/MF A01

The ASME elevated temperature design criteria discussed followed by examples of actual computations performed to support the design/analysis and fabrication of a breeder reactor component in which a substantial amount of elastic-plastic-creep analysis was performed. Mathematical challenges encountered by the design analyst in these problems are highlighted. Developmental needs and future trends are given. DOE

N80-11518# General Atomic Co., San Diego, Calif.
SIMPLIFIED INELASTIC ANALYSIS IN HELICAL COIL HEAT EXCHANGER DESIGN
C. E. Richard Nov. 1978 7 p refs Presented at 3d US Natl. Congr. on Pressure Vessels and Piping, San Francisco, Calif., 25 Jun. 1979
(Contract EY-76-C-03-0167-065)
(GA-A-15188; Conf-790615-5) Avail: NTIS HC A02/MF A01

A simplified, inelastic analysis of helical coil tubing for high-temperature applications is described. Elastically calculated operating stresses are compared with inelastic estimates of allowable cyclic creep/fatigue stresses. The technique of simplifying and analyzing the operating cycles to determine acceptable creep damage levels has general application. The allowable stresses represent the greatest uncertainty in the method, and tests are required to improve their accuracy. A method of utilizing short-time test data to determine allowable stresses for reactor lifetimes of 30 to 40 years is proposed.DOE

N80-11519# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
RESPONSE OF A DOUBLE TUBE SHEET STRUCTURE TO HYDRAULIC PRESSURE TRANSIENTS
W. F. Yau 1979 15 p refs Presented at 3d US Natl. Congr. on Pressure Vessels and Piping, San Francisco, Calif., 25 Jun. 1979
(Contract EY-76-C-09-0001)
(DP-MS-78-73) Avail: NTIS HC A02/MF A01

A general procedure was developed to analyze complex tubesheet structures under dynamic loading conditions. The top shield of a Savannah River Plant production reactor is a stainless steel box structure perforated by tubular conduits. It supports the hanging fuel assemblies and the weight of the reactor superstructure. During normal reactor operation the top shield and the fuel assemblies are submerged in water coolant. For a postulated transient induced by a loss-of-coolant, a loading profile was constructed that considered (1) reduction of buoyancy, (2) rapid pressure changes due to generation and condensation of steam, and (3) vacuum force on one side following condensation. Dynamic responses to such a loading are analytically represented by linear combinations of natural models that satisfy a fourth-order equation of motion. Localized stress magnification in the tube-sheets of the structure is determined according to the theory of perforated plates. DOE

N80-11520# Sandia Labs., Albuquerque, N. Mex.
ASSESSMENT OF STRESS-STRAIN DATA SUITABLE FOR FINITE-ELEMENT ELASTIC-PLASTIC ANALYSIS OF SHIPPING CONTAINERS
H. J. Rack and Gerald A. Knorovsky Sep. 1978 69 p refs
(Contract EX-76-C-04-0789)
(NUREG-CR-0481; SAND-77-1872; R-7) Avail: NTIS

Stress-strain data which describes the influence of strain rate and temperature on the mechanical response of materials presently being used for light water reactor fuel shipping containers have been assembled. Selection of data has been limited to that which is suitable for use in finite-element elastic-plastic analysis of shipping containers (e.g., they must include complete material history profiles). Based on this information, recommendations were made for further work which is required to complete the necessary data base. DOE

N80-11521# Hanford Engineering Development Lab., Richland, Wash.
SPECIMEN SIZE CONSIDERATIONS IN FATIGUE-CRACK GROWTH RATE TESTING
L. A. James Dec. 1978 34 p refs
(Contract EY-76-C-14-2170)
(HEDL-TME-78-99) Avail: NTIS HC A03/MF A01

The effect of specimen size upon the fatigue-crack growth behavior of annealed AISI Type 304 stainless steel was studied at two stress ratios at an elevated temperature. The resulting data were examined in the light of the present ASTM size criterion (based upon monotonic yield strength) as well as a proposed criterion based upon the material flow strength. The flow stress criterion is considerably less restrictive than the present ASTM

Criterion, and is entirely appropriate for strain-hardening materials such as the austenitic stainless steels. DOE

N80-11522# Bari Univ. (Italy). Ist. di Costruzioni di Macchine.

EFFECT OF WELD PENETRATION ON THE STRESS CONCENTRATION FACTOR FOR CRUCIFORM WELDED JOINTS [EFFETTO DELLA MANCANZA DI PENETRAZI ONE SULFATTORE DI EFFETTO DI INTAGLIO PER GIUNTI SALDATI A CROCE]

Bruno Atzori and Carmine Pappalettere Jun. 1978 16 p refs In ITALIAN; ENGLISH summary Presented at Sez. di Brescia, Brescia, Italy, 22-24 Jun. 1978

Avail: NTIS HC A02/MF A01

The influence of the lack of penetration on the elastic stress concentration factor of a cruciform welded joint loaded by axial of bending forces was investigated k sub t. The analysis was performed using finite element techniques with an isoparametric quadrangular element. The computations were carried out on an IBM 370-158. The results are compared with those available in the literature and are applied to justify the different fatigue strength shown by cruciform joints with or without lack of penetration. Author (ESA)

N80-11523# Bari Univ. (Italy). Ist. di Costruzioni di Macchine.

STRESS CONCENTRATION FACTORS FOR FILLET WELDED JOINTS DURING BENDING [FATTORI DI EFFETTO DI INTAGLO PER GIUNTI D'ANGOLO SOLLECITATI A FLESSIONE]

Bruno Atzori and Franco Fresa 1978 17 p refs In ITALIAN; ENGLISH summary Presented at Sez. di Brescia, Brescia, Italy, 22-24 Jun. 1978

Avail: NTIS HC A02/MF A01

The influence of the geometry on the elastic stress concentration factor k sub t for a fillet welded joint during bending was investigated. Complete penetration is assumed for the analysis which was performed by finite element techniques using a plane-stress isoparametric element. Computations were carried out on a IBM 370-158 computer. The results explain the variation in fatigue strength due to variation in sizes of geometrically similar joints which was reported in the literature and is not considered in the existent norms. Author (ESA)

N80-11524# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

FLIGHT SIMULATION FATIGUE CRACK PROPAGATION* EVALUATION OF CANDIDATE LOWER WING SKIN MATERIALS WITH PARTICULAR CONSIDERATION OF *SPECTRUM TRUNCATION

R. J. H. Wanhill 15 Jan. 1979 34 p refs

(Contract NIVR-1806)

(NLR-TR-77092-U) Avail: NTIS HC A03/MF A01

Flight simulation fatigue crack propagation tests were carried out on 2024-T3, 7475-T761, and mill annealed Ti-6Al-4V sheet in thicknesses up to 3 mm. These materials are representative of transport aircraft lower wing skin stiffened panels of end load capacities 1.5 and 3 MN/m. Results show that the performance of 2024-T3 is much superior, owing mainly to greater retardation of crack growth after severe flights. The effect of load truncation is also greater for 2024-T3. The significance of the results in the choice of advanced structural concepts and materials as well as in the choice of truncation level is discussed. A recommendation for further investigation is given.

Author (ESA)

N80-11525# Southampton Univ. (England). Inst. of Sound and Vibration Research.

HIGHER ORDER TAPERED BEAM FINITE ELEMENTS FOR VIBRATION ANALYSIS

C. W. S. To May 1978 51 p refs Sponsored by UK Min. of Defence

(ISVR-TR-99) Avail: NTIS HC A04/MF A01

Explicit expressions for mass and stiffness matrices of two higher tapered beam elements for vibration analysis are presented. One has three degrees of freedom per node and the other has four degrees of freedom per node. The four degrees of freedom of the latter element are the displacement, slope, curvature, and gradient of curvature. The explicit element mass and stiffness matrices eliminate the loss of computer time and round-off errors associated with the extensive matrix operations used in the numerical evaluation of these expressions. Comparisons with results in the literature concerning tapered cantilever beam structures with or without an end mass and its rotary inertia are made. Results show that the higher order tapered beam elements are superior to the lower order one in that they offer more realistic representation of the curvature and loading history of the beam element. Author (ESA)

N80-11526# Ingemanssons Ingenjoersbyraa AB, Goteborg (Sweden).

FORCE AND MOMENT IMPEDANCE OF INFINITE PLATES

Sten Ljunggren Stockholm Swed. Council for Bldg. Res. 1978 176 p refs

(Grant SWEDCBR-730645-7)

(D3-1978; ISBN-91-540-2824-8) Avail: NTIS HC A09/MF A01; Swed. Council for Bldg. Res., Stockholm Skr 45

The mechanical excitation of an infinite plate is described in terms of impedances. Excitations by a force perpendicular to the plate and by a moment with its axis in the plane of the plate applied over an indenter with finite dimensions are treated. Analysis through two-dimensional and three-dimensional bending wave theory was used to describe plate reaction. Exact solutions in closed form for a stiff indenter with a circular area of contact were obtained. Approximate expressions were derived for the case of a rectangular area of contact. Analysis of plate reaction with three-dimensional theory shows that an applied force or moment causes a bending wave and also a longitudinal wave as well as near fields. With three-dimensional theory the case of a small indenter on a thick plate is studied in particular.

Author (ESA)

N80-11003 Allerton Press, Inc., New York, N. Y.

EXPERIMENTAL STUDY OF SHELL STABILITY UNDER HEATING AND LOADING

V. K. Belov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 1-3 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 5-8 (For primary document see N80-11002 02-01)

Copyright. Avail: Allerton Press Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11004 Allerton Press, Inc., New York, N. Y.

ON SOLUTION OF THE PLANE PROBLEM OF REINFORCED PANELS OF VARIABLE STIFFNESS

M. B. Vakhitov, V. N. Paimushin, and N. M. Yakupov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 4-9 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 9-16 (For primary document see N80-11002 02-01)

Copyright. Avail: Allerton Press Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11015 Allerton Press, Inc., New York, N. Y.

ON THE LIMIT STATE OF A TOROIDAL SHELL OF REVOLUTION UNDER AXISYMMETRIC DEFORMATION

I. G. Teregulov and E. S. Sibgatullin *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 74-77 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 92-96 (For primary document see N80-11002 02-01)

Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11017 Allerton Press, Inc., New York, N. Y.

LOAD-CARRYING ABILITY OF CYLINDRICAL SHELL LOADED BY CONCENTRATED FORCE ACTING ALONG THE GENERATOR

A. M. Khomyakov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 84-87 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 104-107 (For primary document see N80-11002 02-01)

Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11018 Allerton Press, Inc., New York, N. Y.
NUMERICAL INTEGRATION OF EQUATIONS OF THEORY OF THIN-WALL BEAMS WITH DEFORMABLE CONTOUR
V. Shatsev *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 88-92 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 108-114 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11023 Allerton Press, Inc., New York, N. Y.
***DETERMINATION OF LOADS AND STRESS IN COMPOSITE* MATERIAL LAYERS FOR A PLATE IN THE PLANE STRESS STATE**
A. A. Dudchenko and A. N. Elpatevskii *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 111-113 ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 132-135 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11025 Allerton Press, Inc., New York, N. Y.
INFLUENCE OF CONTOUR DEFORMATION IN PREBUCKLING STATE ON BENDING STABILITY OF OPEN CYLINDRICAL SHELLS
S. N. Kan, Yu. I. Kaplan, and N. V. Panova *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 117-119 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 138-141 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

42 GEOSCIENCES (GENERAL)

N80-11527# Joint Publications Research Service, Arlington, Va.
GEOPHYSICS, ASTRONOMY AND SPACE, NO. 450
2 Aug. 1979 47 p refs Transl. into ENGLISH from selected *Russian articles*
(JPRS-73946) Copyright. Avail: NTIS HC A03/MF A01

Articles concerning the earth's crust under the ocean, and the upper atmosphere are reported. For individual titles, see N80-11528 through N80-11529.

N80-11528# Joint Publications Research Service, Arlington, Va.
EARTH'S CRUST UNDER THE OCEANS c46
G. B. Rundnik and G. J. Kashintsev *In its* Geophys., Astron. and Space, No. 450 (JPRS-73947) 2 Aug. 1979 p 7-15 refs Transl. into ENGLISH from Priroda (Moscow), no. 4, 1979 p 42-47 (For primary document see N80-11527 02-42)
Avail: NTIS HC A03/MF A01

Differences in the earth's crust on the continents, and under the ocean are discussed in terms of the geological structures. F.O.S.

N80-11529# Joint Publications Research Service, Arlington, Va.
OBSERVATIONS OF ATMOSPHERIC DUST FROM SPACE c46
Al. Grigoryev and K. Kondratyev *In its* Geophys., Astron. and Space, No. 450 (JPRS-73946) 2 Aug. 1979 p 29-37 refs Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 6, 1979 p 88-92 (For primary document see N80-11527 02-42)
Avail: NTIS HC A03/MF A01

The observation from space of atmospheric dust storms over the Aral Sea, Mesopotamia, and the Caspian Sea are analyzed. Climatological changes due to atmospheric dust are discussed. F.O.S.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see *35 Instrumentation and Photography*.

N80-11530# Committee on Science and Technology (U. S. House).
EARTH RESOURCES DATA AND INFORMATION SERVICE
Washington GPO 1979 222 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., No. 24, 2-3 May 1979
(GPO-49-530) Avail: Subcomm. on Space Sci. and Applications

The implementation of and an earth resources data and information service is discussed. Policy issues surrounding the remote sensing of earth resources are presented. The role of the government versus the role of the private sector, the needs of private industry, state and local governments, and the international community are examined in relation to the formation of the earth resources and data information service. A.W.H.

N80-11531# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
AN IMPLICIT COMPACT FOURTH-ORDER ALGORITHM FOR SOLVING THE SHALLOW-WATER EQUATIONS IN CONSERVATION-LAW FORM
I. M. Navon and H. A. Riphagen Jan. 1979 64 p refs
(CSIR-TWISK-57) Avail: NTIS HC A04/MF A01

An alternating direction implicit finite difference scheme is developed for solving the nonlinear shallow water equations in conservation law form. The algorithm is second order time accurate, while fourth order compact differencing is implemented in a spatially factored form. Extraneous boundary conditions required by the fourth order method are determined and a fourth order dissipative term is added to the equations to overcome the increased aliasing due to the fourth order method. The numerical integration is performed in a channel corresponding to a middle latitude band. The integral invariants of the equations are well conserved during the integration, ensuring that a realistic nonlinear structure is obtained. K.L.

N80-11532*# Battelle Columbus Labs., Ohio.
SEASAT DEMONSTRATION EXPERIMENTS WITH THE OFFSHORE OIL, GAS AND MINING INDUSTRIES Final Report
A. G. Mourad, A. C. Robinson, and J. E. Balon Nov. 1979 145 p refs
(Contract NASw-2800)
(NASA-CR-162423; BCL-OA-TFR-79-6) Avail: NTIS HC A07/MF A01 CSCL 05B

Despite its failure, SEASAT-1 acquired a reasonable volume of data that can be used by industrial participants on a non-real-time basis to prove the concept of microwave sensing of the world's oceans from a satellite platform. The amended version of 8 experimental plans are presented, along with a description of the satellite, its instruments, and the data available. Case studies are summarized for the following experiments: (1) Beaufort Sea oil, gas, and Arctic operations; (2) Labrador Sea oil, gas, and sea ice; (3) Gulf of Mexico pipelines; (4) U.S. East Coast offshore oil and gas; (5) worldwide offshore drilling and production operations; (6) Equatorial East Pacific Ocean mining; (7) Bering Sea ice project; and (8) North Sea oil and gas. A.R.H.

N80-11533*# Battelle Columbus Labs., Ohio.
AN ECONOMIC ANALYSIS OF FIVE SELECTED LANDSAT ASSISTED INFORMATION SYSTEMS IN OREGON Final Report
S. Solomon and K. M. Maher Oct. 1979 30 p refs
(Contract NASw-2800)
(NASA-CR-162434; BCL-OA-TFR-79-5) Avail: NTIS HC A03/MF A01 CSCL 05B

A comparative cost analysis was performed on five LANDSAT-based information systems. In all cases, the LANDSAT system

was found to have cost advantages over its alternative. The information sets generated by LANDSAT and the alternative method are not identical but are comparable in terms of satisfying the needs of the sponsor. The information obtained from the LANDSAT system in some cases is said to lack precision and detail. On the other hand, it was found to be superior in terms of providing information on areas that are inaccessible and unobtainable through conventional means. There is therefore a trade-off between precision and detail, and considerations of costs. The projects examined were concerned with locating irrigation circles in Morrow County; monitoring tansy ragwort infestation; inventoring old growth Douglas fir near Spotted Owl habitats; inventoring vegetation and resources in all state-owned lands; and determining and use for Columbia River water policies.
A.R.H.

N80-11534# Naval Ocean Systems Center, San Diego, Calif.
PROCESSING AND DISPLAY TECHNIQUES FOR MULTISPECTRAL SATELLITE IMAGERY Final Report, 1 Feb. - 30 Sep. 1978
J. A. Roese Apr. 1979 39 p refs
(AD-A072509; NOSC/TR-439) Avail: NTIS
HC A03/MF A01 CSCL 09/2

In recent years, the technology area of remote sensing by multispectral satellite sensors has evolved greatly. Imagery obtained by satellite means has been the basis for much work in the areas of environmental studies, resource planning, terrain mapping, weather prediction and military reconnaissance. This program effort has investigated the application of various image processing and display techniques for use with multispectral satellite imagery. Emphasis has been placed on the development and implementation of two-dimensional processing techniques applied in the domain of the original image. Two-dimensional transform domain image processing and display techniques were also adapted for use with satellite imagery. GRA

N80-11535# Army Engineer Topographic Labs., Fort Belvoir, Va.
LAND COVER CLASSIFICATION FROM LANDSAT DATA: PHASE 3 OF A JOINT DOE/NASA DEMONSTRATION Final Report
Richard N. Foreman Mar. 1979 84 p
(AD-A071723; ETL-0175) Avail: NTIS HC A05/MF A01 CSCL 14/5

The Corps of Engineers and NASA's Earth Resources Laboratory conducted a joint demonstration of the production of land cover classification data from LANDSAT data. This report describes Phase III of the demonstration, in which classification maps and data were produced for two Corps of Engineers Districts Wilmington District, an area in the upper Roanoke River basin of Virginia; and Jacksonville District, an area along the route of the Cross Florida Barge Canal. The report includes the Districts' evaluations of the accuracy and applicability of the classifications and cost information for Phase III of the demonstration. The report also includes cost information for the application of interdisciplinary analysis of aerial photography as a means of obtaining land cover and environmental data. LANDSAT data may be cost-effective for identifying and showing the distribution of general types of land cover for large areas, although some land cover types may not be identifiable on a particular LANDSAT scene. Interdisciplinary analysis of aerial photography identifies and explains in a technical report the distribution of land cover. The extra detail of the report and the ability to ensure that specific land cover types are studied may make interdisciplinary analysis of aerial photography cost-effective for limited study areas. GRA

N80-11536# Telecommunications Associates, Fairfax, Va.
INVESTIGATION OF LINEAR TRANSFORMATIONS FOR AUTOMATIC CARTOGRAPHIC ANALYSIS Final Report, Apr. 1978 - Apr. 1979
R. L. Pickholtz, M. Movahed, and S. S. Murty 1 Apr. 1979 189 p refs
(Contract DAAK70-78-C-0045; DA Proj. 4A1-61102-B-52C)
(AD-A071752; TA-79-1-1; ETL-0181) Avail: NTIS
HC A09/MF A01 CSCL 08/2

This report contains a summary of the investigation in applying linear transforms such as Fourier, Bessel, Walsh-Hadamard, Slant and Discrete Cosine to cartographic analysis. Recommendations are made and hardware and software implementations are proposed. GRA

N80-11537# Washington Univ., Seattle. Remote Sensing Applications Lab.
STUDY IN REMOTE SENSING FOR LAND USE Final Report, Apr. 1977 - Jun. 1978
Richard D. Shinn and Frank V. Westerlund Air Force Engineering and Services Lab., Tyndall AFB, Fla. Jun. 1979 74 p refs
(Contract F08635-77-C-0278; AF Proj. 2103)
(AD-A071802; AFESC/ESL-TR-79-15) Avail: NTIS
HC A04/MF A01 CSCL 14/2

This research tested three methods of obtaining land use information by remote sensing for United States Air Force (USAF) land use planning. The three methods tested were: (1) photo interpretation of aircraft photography; (2) equidensitometric processing of aircraft or LANDSAT imagery; and (3) statistical analysis of LANDSAT digital data. The two sites tested were McChord AFB and Fairchild AFB in Washington State. Using test scenarios of mission realignments it was found that photo interpretation was an accurate and ready means to obtain land use information. GRA

N80-11538# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
DETECTION OF ARCTIC WATER SUPPLIES WITH GEOPHYSICAL TECHNIQUES
S. A. Arcone, A. J. Delaney, and P. V. Sellmann Jun. 1979 37 p refs
(DA Proj. 4A7-62730-AT-42)
(AD-A072157; CRREL-79-15) Avail: NTIS HC A03/MF A01 CSCL 13/2

This report discusses the application of several modern geophysical techniques to groundwater exploration in areas in permafrost. These methods utilize the principles of magnetic induction and radiowave surface impedance in the 10- to 400-kHz band, the techniques of impulse and side-looking radar in the 50- to 10,000-MHz band, and also some optical techniques using imagery obtained from a satellite. Low frequency case studies demonstrate the use of the techniques for detecting free water under an ice cover in shallow, almost completely frozen lake basins, and thaw zones within lake beds, stream channels, and in permafrost in general. The radar studies demonstrate the use of these techniques for determining depth of free water and ice cover thickness on lakes and rivers. GRA

N80-11539# Image Graphics, Inc., Fairfield, Conn.
INVESTIGATIONS OF THE USE OF CONVENTIONAL FILMS IN THE ETL CARTOGRAPHIC EBR
Andrew A. Tarnowski 15 Mar. 1979 42 p refs
(Contract DAAK70-77-C-0163)
(AD-A072628; ETL-0177; Rept-4006) Avail: NTIS
HC A03/MF A01 CSCL 14/5

Conventional photographic films sensitive to electrons may be used in the ETL Cartographic EBR provided that image distortions caused by deflection of the electron beam due to electric charge accumulation on the film is within acceptable limits. Various techniques for minimizing film charging problems were investigated and practical solutions are discussed. GRA

N80-11540# RAND Corp., Santa Monica, Calif.
HEURISTICS FOR KNOWLEDGE ACQUISITION FROM MAPS
Perry W. Thorndyke Jul. 1979 40 p refs
(Contract N00014-78-C-0042)
(AD-A073126; RAND/N-1193-ONR) Avail: NTIS
HC A03/MF A01 CSCL 08/2

Acquiring knowledge from a map depends upon procedures for focusing attention, encoding information, and integrating diverse knowledge. This paper describes the heuristics people use to study and learn maps. Verbal protocols obtained from eight subjects suggested four categories of procedures that were invoked during learning: attention, encoding, evaluation, and control. The use of certain heuristics in each category was highly predictive of learning success. Good learners differed from poor learners in their ability to encode spatial information, to evaluate their learning progress, and to focus their attention in accordance

with a learning plan. Many of the successful heuristics appear to be readily trainable. GRA

N80-11541# Ohio State Univ., Columbus. Dept. of Geodetic Science.

A COVARIANCE APPROXIMATION PROCEDURE

Hans Suenkel Hanscom AFB, Mass. AFGL Mar. 1979 66 p refs

(Contract F19628-79-C-0075; AF Proj. 7600)

(AD-A072853; DGS-286; AFGL-TR-79-0075; SR-1) Avail: NTIS HC A04/MF A01 CSCL 08/5

The steadily increasing stream of geodetic data primarily provided by automatized measurement techniques calls for a data processing method which is both simple and fast. The simplicity of least-squares collocation can hardly be surpassed, however, the processing speed, which depends on covariance calculation procedure and matrix inversion algorithms used, can be improved considerably by the feaster covariance computation procedure presented in this report. The method is basically a differentiation interpolation procedure applied to a smooth function interpolating on a regular rectangular grid of exact covariances. Once this covariance network has been generated, the covariance approximation procedure, called COVAPP, is able to provide covariance expressions of second and lower order derivatives of the disturbing potential about ten times faster than existing methods. The approximation error can be kept as small as we please by choosing an appropriately small grid spacing. A FORTRAN IV program listing together with sample inputs and outputs are included in the report. GRA

N80-11542# Honeywell Electro-Optics Center, Lexington, Mass.

STUDY OF TEMPERATURE/MOISTURE RETRIEVAL CAPABILITIES OF DMSP/SSH SENSOR CHANNELS Final Report, 22 Aug. 1977 - 22 Aug. 1978

Alexander S. Zachor 25 Sep. 1978 149 p refs

(Contract F19628-77-C-0184; AF Proj. 7670)

(AD-A073144; HONEYWELL-7809-4; AFGL-TR-78-0279) Avail: NTIS HC A07/MF A01 CSCL 17/5

A number of retrieval algorithms were examinad for efficacy in inferring atmospheric temperature and humidity structure from upwelling earth-atmospheric radiances measured in the sensing bands of DMSP/SSH. Inversions of synthetic radiances for cloud-free conditions were performed to determine the limits on retrieval information. It is shown that the CO2 channels yield fairly accurate temperature retrievals, especially when statistical data are used in constructing a guess profile and in regularizing the solutions. Maximum errors below the 70 mb pressure level are typically 3 to 4 C at middle-to-high latitudes, and 4 to 5 C in the tropics. The analysis used noise-free synthatic radiances, but regularization parameter values were assigned on the basis of measured DMSP noise-equivalent spectral radiances. The humidity retrieval capabilities of the six SSH H2O channels are marginal because three of the channels are redundant, and because the channels are too strongly absorbing to infer low-level moisture except under moderately dry conditions. It was found that substitute window channels near 795 and 900/cm are too opaque to provide an independent determination of total precipitable water, although they are probably good candidates as sounding channels to replace the redundant DMSP. GRA

N80-11543# Los Alamos Scientific Lab., N. Mex.

GEOTHERMAL EXPLORATION METHODS AND RESULTS: INLAND STATES

J. C. Maxwell 1979 3 p refs Presented at Symp. on Geothermal Energy and its Direct Uses in the Eastern United States, Hot Springs, Va., 5 Apr. 1979

(Contract W-7405-eng-36)

(LA-UR-79-665; Conf-790433-2) Avail: NTIS HC A02/MF A01

The Los Alamos Scientific Laboratory geothermal exploration sequence includes: (1) review of AAPG/USGS gradient maps, (2) literature search; (3) consideration of potential markets; (4) groundwater silica geothermometry; (5) analysis of bottom-hole temperatures; (6) heat flow measurement of available wells; and (7) drilling of new tests holes. Anomalies were located near Syracuse, NY (36 C/km, 56 C silica max.), near Buffalo, NY (36 C/km, 65 C silica max.), southeast Ohio, western and southwestern Nebraska, and three new warm springs in Arkansas. Other investigations found high heat generation (14 to 25 HGU) in the White Mountain batholith NH (170 C calculated at 6 km depth), uparching of the Adirondac Dome, NY, and potentially economic electricity from hot brines in southwest Arkansas.DOE

N80-11544# Texas Univ., Austin.

TERTIARY OIL RECOVERY PROCESSES RESEARCH AT THE UNIVERSITY OF TEXAS Annual Report, Oct. 1977 - Sep. 1978

R. S. Schechter and W. H. Wade Washington DOE Dec. 1978 61 p refs

(Contract EW-78-S-19-0001)

(BETC-0001-1) Avail: NTIS HC A04/MF A01

Many species of monoisomeric alkyl-substituted benzene sulfonates were synthesized and examined at low concentrations. Interfacial tension in particular was studied. Optimum salinity for high surfactant concentrations was defined as the middle of the 3-phase region. Work on surfactant adsorption was focused on a model that can explain maxima and minima in adsorption curves. A model for diffusion and stranding at the aqueous surfactant-oil interface was applied to spontaneous emulsification and extended to systems that form middle-phase microemulsions. DOE

N80-11545# Pennzoil Co., Vienna, W. Va.

OIL RECOVERY BY CARBON DIOXIDE INJECTION Annual Report, Jul. 1977 - Jul. 1978

L. G. Guckert and G. P. SanFilippo DOE Sep. 1978 57 p

(Contract EF-76-C-05-5301)

(ORO-5301-34) Avail: NTIS HC A04/MF A01

A project to determine the feasibility of miscible carbon dioxide oil recovery in the Rock Creek Big Injun field in Roane County, West Virginia is now showing a response to waterflood. Water injection into the backup injection wells was initiated on October 16, 1976 and water injection into the six pattern injection wells commenced on April 22, 1977. As of July 1, 1978, the cumulative injection into the nineteen injection wells totaled 1,306,966 barrels. DOE

N80-11546# Gary Operating Co., Englewood, Colo.

BELL CREEK RESIDUAL OIL SATURATION TECHNOLOGY TEST Quarterly Report, Oct. 1978 - Dec. 1978

D. Myal 18 Jan. 1979 7 p

(Contract ET-78-C-03-2180)

(BETC-2180-4) Avail: NTIS HC A02/MF A01

The capabilities of different techniques to measure residual oil saturation, in situ, in a consolidated sandstone reservoir were assessed to provide a basis for d selecting appropriate methods for determining oil saturation at tertiary recovery pilot test sites. DOE

N80-11547# Technical Research Centre of Finland, Espoo. Lab. of Land Use.

AUTOMATED EARTH RESOURCES SURVEYS USING SATELLITE AND AIRCRAFT SCANNER DATA: A FINNISH APPROACH

Einari Kilpelse, Sipi Jaakkola, Risto Kuittinen, and Jouko Talvitie 1978 174 p refs Co-Sponsored by Finn. Natl. Fund for Res. and Develop., Acad. of Finland, Found. for Res. of Nat. Res., Min. of Trade and Ind., Sci. Comm. of Natl. Defence Original contains color illustrations

(VTT-LU-15; ISBN-951-38-0723-1) Avail: NTIS HC A08/MF A01

A tree-year multidisciplinary earth resources oriented remote sensing project was carried out to develop automated environment monitoring and natural resources inventory methods for Finnish conditions and to study the technical feasibility of such methods in the fields of water resources, geology, agriculture, and forestry. Both satellite (LANDSAT) and aircraft scanner data from several test sites in southern Finland were used in the study. Data acquisition and analysis procedures as well as the results obtained are discussed. The results justify more detailed remote sensing research on various problems in all fields cited. Author (ESA)

N80-11548# Connecticut Univ., Storrs. Inst. of Water Resources.

DETERMINATIONS OF HYDROLOGIC PARAMETERS FOR

GLACIAL TILLS IN CONNECTICUT Final Report
David Huntley and Robert F. Black 30 Jun. 1979 20 p refs
(Contract DI-14-34-0001-7014)
(PB-297578/7; W79-07715; OWRT-A-077-CONN(2)) Avail: NTIS HC A02/MF A01 CSCL 13B

Glacial tills located in the upland areas of the Shetucket and Quinebaug River basins, Connecticut, were evaluated for transmissivity and hydraulic conductivity by performing slug-injection tests on nine, small diameter drilled wells and slug-withdrawal tests on nineteen existing, dug wells. Test data yielded values of horizontal hydraulic conductivity that ranged from 1.0 to 355 gpd/sq ft (0.13 to 14.46 m/day). Laboratory-determined values of horizontal hydraulic conductivity were obtained using specially-constructed permeameters on relatively undisturbed samples of till. Computer-model simulations of waste movement through a till aquifer, have widespread application relative to the design of sanitary landfills and other forms of waste disposal in till and stratified sediments. GRA

N80-11548# New York Univ., N. Y. Graduate School of Public Administration.
INSTITUTIONAL CONSTRAINTS ON LAND MANAGEMENT FOR WATER RESOURCE PROTECTION IN URBAN AND SUBURBAN WATERSHEDS
Rae Zimmerman Jul. 1979 98 p refs
(Contract DI-14-34-0001-8013; OWRT Proj. B-075-NY(1))
(PB-298271/8; W79-08341) Avail: NTIS HC A05/MF A01 CSCL 13B

Land management activities which contribute to adverse changes in both water quality and natural hydrology are operations and maintenance functions basic to infrastructure, such as street sanitation and repair, snow removal, maintenance of parks, catchbasins and sewers, and pesticide use. Insights into institutional constraints for avoiding adverse water resource effects related to: (1) adaptability of land management functions to new goals; (2) relationship of an inability to establish liasions with environmental concerns and role perceptions, organizational attributes, and manpower; and (3) viability of networking existing agencies for new goals for water resource goal implementation via land management. An interview questionnaire was sent to 36 officials in 17 localities in the lower Hudson. GRA

N80-11550# Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
INTERACTIVE WATER RESOURCES PLANNING USING COMPUTER GRAPHICS
Peter N. French, Lynn E. Johnson, Daniel P. Loucks, and Donald P. Greenberg Jan. 1979 91 p refs
(Contract DI-14-34-0001-6226; OWRT Proj. C-7183(6226)(4))
(PB-297994/6; W79-08196) Avail: NTIS HC A05/MF A01 CSCL 13B

Computer-aided design methods for water resources planning using interactive computer graphics routines are presented. Five specific types of problems, including water quality prediction, parameter identification, flood management, reservoir simulation, and multiobjective reservoir-water supply planning are illustrated. In all cases, tablet digitizing routines were used for the input of spatial and other data, and vector display methods were used for the graphical output. Visual feedback is provided at all stages of the procedures. The interactive computer graphics methods provide many advantages, including convenience, flexibility, the reduction of input errors, and improved communication and response time. GRA

N80-11551# West Virginia Univ., Morgantown. Thermal-Hydraulics Lab.
EFFECT OF VERTICAL SCALE DISTORTION ON THE TEMPERATURE FIELD OF A THERMAL-HYDRAULIC MODEL
D. P. Michelotti, R. A. Bajura, and S. H. Swartz Nov. 1978 131 p refs
(Contract DI-14-34-0001-6214; OWRT Proj. C-7171(6214)(4))
(PB-297274/3; DPM-RAB/SHS-78-1; RR-9) Avail: NTIS HC A07/MF A01 CSCL 13B

The generation of electricity by pumped storage hydroelectric plants to supplement existing thermal power plant facilities for peak energy supply is discussed and the effects of a vertical scale distortion on the flow and temperature fields of a hydraulic model of a pumped storage reservoir system are assessed. Vertical to horizontal scale ratios of 1:1, 3:1, and 5:1 were considered. The model consisted of a submerged hot water jet discharging into an initially cold isothermal reservoir. The jet discharge geometry was patterned after what was considered to be a typical pumped storage outlet. Results are presented for various jet Froude numbers. GRA

N80-11552# National Oceanic and Atmospheric Administration, Highlands, N. J. Northeast Fisheries Center.
RECONNAISSANCE SURVEY OF THE DISTRIBUTION AND ABUNDANCE OF BENTHIC ORGANISMS IN THE NEW YORK BIGHT APEX 5-14 JUNE 1973 Data Report
John Pearce, John Pearce, Clyde MacKenzie, Janice Caracciolo, and Leslie Rogers Oct. 1978 15 p refs
(PB-297333/7; NOAA-DR-ERL-MESA-41; NOAA-79051402)
Avail: NTIS HC A02/MF A01 CSCL 13B

A reconnaissance cruise to stations within the New York Bight apex provided a baseline to be used in assessing the impacts of contaminants from all sources, particularly ocean dumping, on the sediments in this area. Machine listed data and certain statistical calculations, diversity and equitability concerned with the distribution and abundance of benthic invertebrate organisms found in the New York Bight apex is provided. Data from these samples, when compared with data collected at later dates, will provide a baseline against which seasonal and temporal changes in the Bight may be assessed. GRA

N80-11553# National Technical Information Service, Springfield, Va.
REMOTE SENSING APPLIED TO HYDROLOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Audrey S. Hunderman Aug. 1979 219 p Supersedes NTIS/PS-78/0792 and NTIS/PS-77/0677
(NTIS/PS-79/0845/2; NTIS/PS-78/0792; NTIS/PS-77/0677)
Avail: NTIS HC $28.00/MF $28.00 CSCL 08H

The use of aerial and satellite imagery in hydrologic studies, including water resources planning and management, is discussed. The abstracts cover remote sensing studies of water quality, soil moisture, floodplain delineration, ice cover, and determination of snow depth and water equivalent. This updated bibliography contains 210 abstracts, 22 of which are new entries to the previous edition. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-11554 International Institute for Applied Systems Analysis, Laxenburg (Austria).
MEDEE 2: A MODEL FOR LONG TERM ENERGY DEMAND EVALUATION
Bruno Lapillonne Nov. 1978 53 p refs
(IIASA-RR-78-17) Avail: Issuing Activity

A simulation model, MEDEE 2, designed to evaluate the long-term energy demand of a country in combination with a scenario description of the main aspects of the country's social, economic, and technological evolution is described. Parameters taken into consideration are end-use total demand by category (e.g., residential space heating, service sector cooling, gasoline for intercity cars)and the potential market (maximum demand that can be technically met) for each final energy form (electricity, coal, gas, solar, oil products, and district heat). The model also calculates useful energy demand in each end-use category for

which several energy forms can be used, thus determining the substitution possibilities is energy use. The scenario description is complemented with technological parameters (e.g., insulation standards, efficiencies, fuel mix), the evolution of which is specified in a way consistent with the macroeconomic assumptions.
Author (ESA)

N80-11555*# North Georgia Area Planning and Development Commission, Dalton.

SOLAR ENERGY SYSTEM INSTALLED AT THE NORTH GEORGIA APDC OFFICE BUILDING

Aug. 1979 131 p refs Sponsored by NASA
(Contract EG-77-A-01-4075)
(NASA-CR-161273) Avail: NTIS HC A07/MF A01 CSCL 10A

A hydronic, automatic drain-down solar heating and cooling system is described. The system provides solar heat exchange from a 2,001 square foot effective collector area and supplies 65-70 percent of the building's cooling demand, 90-95 percent of the heating demand, and domestic hot water. The acceptance test plan and results, system operation and maintenance, and predicted system performance are presented. J.M.S.

N80-11556# Committee on Interstate and Foreign Commerce (U. S. House).

SOLAR COMMERCIALIZATION

Washington GPO 1979 548 p refs Hearings before the Subcomm. on Energy and Power of the Comm. on Interstate and Foreign Commerce, 96th Congr., 1st Sess., 10-11 Jan. 1979
(GPO-43-586) Avail: Subcomm. on Energy and Power

Government policies to commercialize solar energy and a program to encourage solar energy commercialization are examined. Solar energy technology and the applications of this technology are discussed. The role of government in solar energy commercialization is debated. A.W.H.

N80-11557# Committee on Energy and Natural Resources (U.S. Senate).

ENERGY INITIATIVES OF THE 95TH CONGRESS

Washington GPO 1979 342 p refs Rept. for Comm. on Energy and Natural Resources, 96th Congr., 1st Sess., May 1979
(GPO-42-797; Publ-96-10) Avail: SOD HC

Congressional response to the energy problem is defined and assessed. Actions toward the utilization of solar energy, nuclear energy, geothermal energy, and the production of alcohol fuels, natural gas, and crude oils is reported. A.W.H.

N80-11558*# General Electric Co., Philadelphia, Pa. Space Div.

EXECUTIVE SUMMARY: MOD-1 WIND TURBINE GENERATOR ANALYSIS AND DESIGN REPORT Final Report

Mar. 1979 61 p
(Contracts NAS3-20058; EC-77-A-29-1010)
(NASA-CR-159497; DOE/NASA/0058-79/3) Avail: NTIS HC A04/MF A01 CSCL 10A

Activities leading to the detail design of a wind turbine generator having a nominal rating of 1.8 megawatts are reported. Topics covered include (1) system description; (2) structural dynamics; (3) stability analysis; (4) mechanical subassemblies design; (5) power generation subsystem; and (6) control and instrumentation subsystem. A.R.H.

N80-11559*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AN EVALUATION OF THE NASA TECH HOUSE, INCLUDING LIVE-IN TEST RESULTS, VOLUME 1

Ira H. A. Abbott, Kenneth A. Hopping, and Warren D. Hypes Nov. 1979 72 p refs
(NASA-TP-1564; L-13440) Avail: NTIS HC A04/MF A01 CSCL 10A

The NASA Tech House was designed and constructed at the NASA Langley Research Center, Hampton, Virginia, to demonstrate and evaluate new technology potentially applicable for conservation of energy and resources and for improvements in safety and security in a single-family residence. All technology items, including solar-energy systems and a waste-water-reuse system, were evaluated under actual living conditions for a 1 year period with a family of four living in the house in their normal lifestyle. Results are presented which show overall savings in energy and resources compared with requirements for a defined similar conventional house under the same conditions. General operational experience and performance data are also included for all the various items and systems of technology incorporated into the house design. Author

N80-11560*# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.

SOLAR HEATING AND COOLING SYSTEMS DESIGN AND DEVELOPMENT Quarterly Report, 9 Oct. 1978 - 9 Jan. 1977

Jan. 1977 198 p
(Contract NAS8-32093)
(NASA-CR-150873; F3737-QR-102) Avail: NTIS HC A09/MF A01 CSCL 10A

Progress in the development of prototype solar heating/cooling systems is reported. Results obtained from refinement/improvement of the single family, multifamily, and commercial systems configurations and generalized studies on several of the subsystems are presented. J.M.S.

N80-11561*# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.

SILICON SOLAR CELL PROCESS DEVELOPMENT, FABRICATION AND ANALYSIS, PHASE 1 Annual Report, 15 Jun. 1978 - 15 Jun. 1979

H. I. Yoo, P. A. Iles, and D. P. Tanner 15 Jun. 1979 174 p refs
(Contract JPL-955089)
(NASA-CR-162427; DOE/JPL-955089-79/4; DRL-74/DRD-SE) Avail: NTIS HC A08/MF A01 CSCL 10A

Solar cells from RTR ribbons, EFG (RF and RH) ribbons, dendritic webs, Silso wafers, cast silicon by HEM, silicon on ceramic, and continuous Czochralski ingots were fabricated using a standard process typical of those used currently in the silicon solar cell industry. Back surface field (BSF) processing and other process modifications were included to give preliminary indications of possible improved performance. The parameters measured included open circuit voltage, short circuit current, curve fill factor, and conversion efficiency (all taken under AM0 illumination). Also measured for typical cells were spectral response, dark I-V characteristics, minority carrier diffusion length, and photoresponse by fine light spot scanning. the results were compared to the properties of cells made from conventional single crystalline Czochralski silicon with an emphasis on statistical evaluation. Limited efforts were made to identify growth defects which will influence solar cell performance. A.R.H.

N80-11562*# Motorola, Inc., Scottsdale, Ariz.

THE AUTOMATED ARRAY ASSEMBLY TASK OF THE LOW-COST SILICON SOLAR ARRAY PROJECT, PHASE 2 Annual Report

M. G. Coleman, L. P. Grenon, E. M. Pastirik, R. A. Pryor, and T. G. Sparks Nov. 1978 213 p
(Contract JPL-954847; Proj. 2345)
(NASA-CR-162429; DOE/JPL-954847-78/4) Avail: NTIS HC A10/MF A01 CSCL 10A

An advanced process sequence for manufacturing high efficiency solar cells and modules in a cost-effective manner is discussed. Emphasis is on process simplicity and minimizing consumed materials. The process sequence incorporates texture etching, plasma processes for damage removal and patterning, ion implantation, low pressure silicon nitride deposition, and plated metal. A reliable module design is presented. Specific process step developments are given. A detailed cost analysis was performed to indicate future areas of fruitful cost reduction effort. Recommendations for advanced investigations are included. A.R.H.

N80-11563*# Boeing Engineering and Construction, Seattle, Wash.

WIND LOADS ON FLAT PLATE PHOTOVOLTAIC ARRAY FIELDS Final Report

Ronald Miller and Donald Zimmerman Sep. 1979 112 p refs
Prepared for JPL and DOE

(Contract JPL-954833)
(NASA-CR-162424; DOE/JPL-954833-79/2) Avail: NTIS HC A06/MF A01 CSCL 10A

The aerodynamic forces resulting from winds acting on flat plate photovoltaic arrays were investigated. Local pressure distributions and total aerodynamic forces on the arrays are shown. Design loads are presented to cover the conditions of array angles relative to the ground from 20 deg to 60 deg, variable array spacings, a ground clearance gap up to 1.2 m (4 ft) and array slant heights of 2.4 m (8 ft) and 4.8 m (16 ft). Several means of alleviating the wind loads on the arrays are detailed. The expected reduction of the steady state wind velocity with the use of fences as a load alleviation device are indicated to be in excess of a factor of three for some conditions. This yields steady state wind load reductions as much as a factor of ten compared to the load incurred if no fence is used to protect the arrays. This steady state wind load reduction is offset by the increase in turbulence due to the fence but still an overall load reduction of 2.5 can be realized. Other load alleviation devices suggested are the installation of air gaps in the arrays, blocking the flow under the arrays and rounding the edges of the array. A wind tunnel test plan to supplement the theoretical study and to evaluate the load alleviation devices is outlined.
A.R.H.

N80-11564*# Hughes Research Labs., Malibu, Calif.
ELECTRON RADIATION DAMAGE OF (AlGa) As-GaAs SOLAR CELLS Final Report, 25 Apr. 1978 - 24 Apr. 1979
R. Loo, G. S. Kamath, and R. Knechtli Oct. 1979 71 p refs
Prepared for JPL
(Contract NAS7-100)
(NASA-CR-162425) Avail: NTIS HC A04/MF A01 CSCL 10A

Solar cells (2 cm by 2 cm (AlGa) As-GaAs cells) were fabricated and then subjected to irradiation at normal incidence by electrons. The influence of junction depth and n-type buffer layer doping level on the cell's resistance to radiation damage was investigated. The study shows that (1) a 0.3 micrometer deep junction results in lower damage to the cells than does a 0.5 micrometer junction, and (2) lowering the n buffer layer doping density does not improve the radiation resistance of the cell. Rather, lowering the doping density decreases the solar cell's open circuit voltage. Some preliminary thermal annealing experiments in vacuum were performed on the (AlGa)As-GaAs solar cells damaged by 1-MeV electron irradiation. The results show that cell performance can be expected to partially recover at 200 C with more rapid and complete recovery occurring at higher temperature. For a 0.5hr anneal at 400 C, 90% of the initial power is recovered. The characteristics of the (AlGa)As-GaAs cells both before and after irradiation are described. R.E.S.

N80-11565*# Solarex Corp., Rockville, Md.
PHASE 2 OF THE ARRAY AUTOMATED ASSEMBLY TASK FOR THE LOW COST SILICON SOLAR ARRAY PROJECT
Manfred Wihl, John Torro, Alan Scheinine, and Jack Anderson Nov. 1978 86 p Sponsored by JPL and DOE
(Contract JPL-954854)
(NASA-CR-162426; DOE/JPL-954854-77/4) Avail: NTIS HC A05/MF A01 CSCL 10A

An automated process sequence, to manufacture photovoltaic modules at a capacity of approximately 500 MW per year at a cost of approximately $0.50 per peak watt is described. Verification tests were performed and are reported along with cost predictions. R.E.S.

N80-11566*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CHARACTERIZATION OF SOLAR CELLS FOR SPACE APPLICATIONS. VOLUME 10: ELECTRICAL CHARACTERISTICS OF SPECTROLAB BSF, TEXTURED, 10 OHM-CM, 300 MICRON CELLS AS A FUNCTION OF INTENSITY, TEMPERATURE AND IRRADIATION
B. E. Anspaugh, R. G. Downing, T. F. Miyahira, and R. S. Weiss 1 Oct. 1979 38 p
(Contract NAS7-100)
(NASA-CR-162422; JPL-Pub-78-15-Vol-10) Avail: NTIS HC A03/MF A01 CSCL 10A

Electrical characteristics of textured, back surface field, 10 ohm cm, 300 micron N/P silicon solar cells are presented in graphical and tabular format as a function of solar illumination intensity, and temperature. Author

N80-11567# California Univ., Berkeley. Lawrence Berkeley Lab.
ON-LINE TESTS OF ORGANIC ADDITIVES FOR THE INHIBITION OF THE PRECIPITATION OF SILICA FROM HYPERSALINE GEOTHERMAL BRINE. 2: TESTS OF NITROGEN-CONTAINING COMPOUNDS, SILANES, AND ADDITIONAL ETHOXYLATED COMPOUNDS
J. E. Harrar, F. E. Locke, C. H. Otto, Jr., L. E. Lorensen, and W. P. Frey 1 Jun. 1979 24 p refs
(Contract W-7405-eng-48)
(UCID-18195) Avail: NTIS HC A02/MF A01

Several new classes of organic compounds were screened as potential geothermal scale control agents by examining their effect on the precipitation of silica from Magmamax No. 1 brine. The substances were tested using the Brine Treatment Test System at the Niland, California, Test Site. Solutions of the test substances were injected into flowing brine at 210 C, the brine was flashed to 125 C, and then the kinetics of solids and silica precipitation from effluent brine held at 90 C were measured. Three new types of compounds were shown to have activity as precipitation inhibitors: polyethylene imines, polyethyloxazalines, and quaternary ammonium compounds containing polyoxyethylene. Among the latter, Ethoquad 18/24, which is methylpolyoxyethylene(15) octadecylammonium chloride, is the leading candidate antiscalant. It is a more powerful inhibitor of silica precipitation than the pure polyoxyethylene polymers, and it apparently has no high temperature solubility limitations. Measurements were made of the concentrations of monomeric silica and the effect of addition of inhibitor at various points in the Brine Treatment Test System. DOE

N80-11568# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
LITHIUM-THIONYL CHLORIDE BATTERY Quarterly Report, 1 Jan. - 31 Mar. 1979
A. N. Dey, W. Bowden, J. Miller, and P. Witalis Jul. 1979 69 p
(Contract DAAB07-78-C-0563; DA Proj. 1L1-62705-AH-94)
(AD-A072358; DELET-TR-78-0563-2) Avail: NTIS HC A04/MF A01 CSCL 10/3

This report describes the Li/SOCl2 inorganic electrolyte system, which is the highest energy density system known to date. It consists of a Li anode, a carbon cathode and SOCl2 which acts both as a solvent and as a cathode active material. The electrolyte salt that has been used most extensively is LiAlCl4, but salts such as Li2B10Cl10 and Li2O(AlCl3)2 have also been used successfully in this system for improving the shelf life characteristics. The main objective of this program is to develop high rate Li/SOCl2 cells and batteries for portable applications of the U. S. Army. The cells and batteries must deliver higher energy densities than are presently available and must be safe to handle under U. S. Army field conditions. GRA

N80-11569# Princeton Univ., N. J. Plasma Physics Lab.
ENERGY STORAGE FOR TOKAMAK REACTOR CYCLES
C. H. Buchanan Jan. 1979 31 p refs
(Contract EY-76-C-02-3073)
(PPPL-1511) Avail: NTIS HC A03/MF A01

The problem of energy storage to permit continuous electrical output to the power grid of a Tokamak reactor cycle is discussed. The cycle under consideration is a 1000 second burn followed by a 100 second reignition phase. DOE

N80-11570*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SAMICS: INPUT DATA PREPARATION
R. G. Chamberlain and R. W. Aster 1 Mar. 1979 35 p ref
Revised
(NASA-CR-162421; DOE/JPL-1012-22-Rev-A) Avail: NTIS HC A03/MF A01 CSCL 10A

The Solar Array Manufacturing Industry Costing Standards (SAMICS) provide standard formats, data, assumptions, and procedures for estimating the price that a manufacturer would have to charge for the product of a specified manufacturing process sequence. A line-by-line explanation is given of those standard formats which describe the economically important

characteristics of the manufacturing processes and the technological structure of the companies and the industry. This revision provides an updated presentation of Format A Process Description, consistent with the October 1978 version of that form. A checklist of items which should be entered on Format A as direct expenses is included. DOE

N80-11571# Rocket Research Corp., Redmond, Wash.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEM DEVELOPMENT Interim Report
Feb. 1979 105 p refs
(Contract W-31-109-eng-38)
(ANL/ICES-TM-27) Avail: NTIS HC A06/MF A01

Heat pump centered intergrated community energy systems (HP-ICES) are energy systems for communities which provide heating, cooling, and/or other energy services through the use of heat pumps. Since heat pumps primarily transfer energy from existing and otherwise probably unused sources, rather than convert it from electrical or chemical to thermal form, HP-ICES are viewed as having significant potential for energy conservation. The System Development phase of the HP-ICES project is described and the results are reported. DOE

N80-11572# Dubin-Bloome Associates, New York.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEMS DEVELOPMENT, DUBIN-BLOOME ASSOCIATES
Fred S. Dubin, A. Halfon, and P. Herzog Feb. 1979 242 p refs
(Contract W-31-109-eng-38)
(ANL/ICES-TM-29) Avail: NTIS HC A11/MF A01

A heat pump centered integrated community energy system (HP-ICES) which provides all the heating, cooling, and other energy requirements to an entire community is investigated. The ice generating HP-ICES which uses the heat of fusion of water as a heat source for the heat pump, thus converting the water into ice, is described. The ice is stored in a bin and used the following summer for cooling. The systems performance and engineering are evaluated and a comparison is made with conventional heating systems. A.W.H.

N80-11573# Mechanical Technology, Inc., Latham, N. Y.
HIGH COP HEAT PUMP SYSTEM, PHASE 1, RESULTS
Apr. 1979 151 p
(Contract EC-77-C-01-5056)
(HCP/M5056-01; TR-1) Avail: NTIS HC A08/MF A01

The High COP Heat Pump System described is a device for recovering heat or energy usually lost in process streams by rejection to once-through cooling systems. The acetone recovers process makes use of river water to cool process streams, with the river water taking on heat in the heat exchange process. Heat or energy is thereby rejected from the process stream and is not recovered for reuse. The MTI Heat Pump System allows reuse of this energy. The estimated cost of a production Heat Pump System is $625,000 plus installation. The system can deliver 20 million BTU's per hour of latent steam energy. Based on a steam cost of $1.89 million BTU's for natural gas, the system being in service for 7884 hours per year (90% in-service rate), a 20% investment tax credit and installation costs at 50% of hardware costs; the discounted cash flow rate of return is 29.5%. Breakeven points are 2.6, 3.6, and 4 years for oil, gas and coal respectively. Details are provided about the Heat Pump System operation in the section entitled Process Description. Cycle Optimization is discussed, providing insight on the technique of determining the optimum system configuration. System Sensitivity shows how relatively little the output varies with changes in turbine and compressor efficiencies. Details of System Design are given, in which design objectives, applicable codes, working fluid, general arrangement, and component design features are discussed. Installation at the host site is analyzed, as is System Cost. Under Environmental Effects, it is shown that the Heat Pump System will increase the quality of the environment. DOE

N80-11574# Georgia Inst. of Tech., Atlanta.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS; SYSTEM DEVELOPMENT Interim Report
D. W. Wade, B. C. Trammel, B. S. Dixit, D. C. McCurry (McCurry and Assoc., Atlanta), and B. A. Rindt (McCurry and Assoc., Atlanta) Feb. 1979 201 p refs Prepared for Argonne National Lab.
(Contract W-31-109-eng-38)
(ANL-ICES-TM-28) Avail: NTIS HC A10/MF A01

The heat pump - wastewater heat recovery (HP-WHR) scheme is one approach to heat pump centered integrated community energy systems that proposes to reclaim low grade thermal energy from a community's wastewater effluent. The concept of an HP-WHR system is developed, the potential performance and economics of such a system is evaluated and the potential for application is examined. A thermodynamic performance analysis of a hypothetical system projects an overall system coefficient of performance of from 2.181 to 2.264 for wastewater temperatures varying from 50 F to 80 F. Primary energy source savings from the implementation of this system is projected to be 5.014 QUADS, or the energy equivalent of 687 millions tons of coal, from 1980 to the year 2000. Economic analysis shows the HP-WHR scheme to be cost competitive, on the basis of a net present value life cycle cost comparison, with conventional residential and light commercial systems. DOE

N80-11575# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEM; SYSTEM DEVELOPMENT Interim Report
Mar. 1979 153 p refs Prepared for Argonne National Lab.
(Contract W-31-109-eng-38)
(ANL/ICES-TM-31) Avail: NTIS HC A08/MF A01

Heat Pump Centered-Integrated Community Energy System (HP-ICES), based on the use of privately owned heat pumps in each building within a community, is described. The heat pumps will provide all of the space heating, space cooling and domestic hot water needs. All of the energy required is provided by electrical power, thereby eliminating a community's dependence on gas or oil supplies. The electrical power can be generated using any available fuel. The heat pumps will operate in both air and water source modes, deriving the best performance advantages of both. The water source, provided to the users by a community-owned distribution system dedicated to HP-ICES use, is closed-loop. During most of the winter heating season, the heat pumps will operate from the community water source, extracting the latent heat of the water and thereby producing ice. This ice will be pumped back into the same community main from which the water was originally withdrawn. Thus, the community water main becomes, in addition to a simple water supply, an energy sink fund from which individual users can draw as required. The residences draw off water and return ice; the commercial buildings draw off chilled water and/or ice and return warmed water. DOE

N80-11576# Argonne National Lab., Ill. Energy and Environmental Systems Div.
TRANSFER OF ENERGY CONSERVATION TECHNOLOGY TO INDUSTRY. A PRELIMINARY SURVEY OF EXISTING MECHANISMS
Carolyn S. Colsher and Allan R. Evans Sep. 1978 55 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-28) Avail: NTIS HC A04/MF A01

To ascertain the current level of interest, capabilities, and involvement in the dissemination of information on industrial energy conservation, a survey was conducted. Based upon 150 responses from major groups, it was found that although form and level of activity varied widely, the most frequently used communications channels were workshops, seminars, conferences, energy audits, energy committees, and distribution of literature. Among the areas cited as needing improvement was (1) awareness and acquisition of literature and (2) availability of industry or process specific technical manuals for plant managers or engineers. The most successful government/industry interfaces were felt to be workshops held cooperatively with trade associations, programs to encourage sharing of generic conservation techniques between firms, and published literature. DOE

N80-11577# Argonne National Lab., Ill. Energy and Environmental Systems Div.

IMPLEMENTING ENERGY CONSERVATION STRATEGIES IN ENERGY MATERIALS TRANSPORT: U. S. DEPARTMENT OF ENERGY AND OTHER GOVERNMENT AGENCY POLICY-MAKING DECISIONS

K. M. Bertram Nov. 1978 62 p refs

(Contract W-31-109-eng-38)

(ANL/EES-TM-32) Avail: NTIS HC A04/MF A01

The policy-making channels within Federal agencies for the strategy implementation efforts of U. S. Department of Energy conservation projects are defined. Government agency policy-making mechanisms are reviewed and analyzed. Emphasis was placed upon relevant Federal agencies and summary treatment given other federal, state, and local agencies. Brief case studies were made of states and localities which have significant effects upon energy materials transport systems. The main findings of the report are that two primary channels exist for effecting this project's policy-oriented strategies: inputs to legislation and inducement of regulatory involvements. DOE

N80-11578# Department of Energy, Washington, D. C. Office of Solar, Geothermal, Electric and Storage Systems.

WIND ENERGY SYSTEMS: PROGRAM SUMMARY

Dec. 1978 134 p refs

(DOE/ET-0093) Avail: NTIS HC A07/MF A01

Projects to develop reliable and economically viable wind energy systems and enable the earliest possible commercialization of wind power are described. The program's general organization is also described. DOE

N80-11579# California Univ., Berkeley. Lawrence Berkeley Lab.

GEOTHERMAL ENERGY FOR INDUSTRIAL APPLICATION

R. L. Fulton Mar. 1979 19 p refs Presented at Assoc. of Energy Engineers Conf., San Francisco, Calif., 21 Mar. 1979

(Contract W-7405-eng-48)

(LBL-8919; Conf-790358-1) Avail: NTIS HC A02/MF A01

The types of geothermal resources are reviewed briefly. The uses of geothermal energy for electrical generation and non-electric direct use are described. DOE

N80-11580# Sandia Labs., Albuquerque, N. Mex.

CONCENTRATING SOLAR COLLECTOR TEST RESULTS COLLECTOR MODULE TEST FACILITY (CMTF) Summary Report, Jan. - Dec. 1978

V. E. Dudley and R. M. Workhoven Mar. 1979 54 p refs

(Contract EY-76-C-04-0789)

(SAND-78-0977) Avail: NTIS HC A04/MF A01

The results are summarized of tests on four concentrating solar collectors at output fluid temperatures from 100 C to 300 C. DOE

N80-11581# Sandia Labs., Albuquerque, N. Mex.

HEAT LOSS REDUCTION TECHNIQUES FOR ANNULAR SOLAR RECEIVER DESIGNS

A. C. Ratzel and C. E. Simpson Feb. 1979 56 p refs

(Contract EY-76-C-04-0789)

(SAND-78-1769) Avail: NTIS HC A04/MF A01

Analytical and experimental work was undertaken to quantify thermal conduction and natural convection heat losses in annular solar receiver geometries. Techniques studied for reducing conduction heat loss include evacuation of the annulus gas, oversizing of the annular space while maintaining slight vacuum levels, and use of gases other than air in the annular space. DOE

N80-11582# Sandia Labs., Albuquerque, N. Mex.

DESIGN CONSIDERATIONS FOR A PROPOSED PASSIVE VACUUM SOLAR ANNULAR RECEIVER

T. D. Harrison, G. N. Bond, and A. C. Ratzel Apr. 1979 43 p refs

(Contract EY-76-C-04-0789)

(SAND-78-0982) Avail: NTIS HC A03/MF A01

Testing of an east-west 90 deg parabolic trough collector revealed problems associated with achieving and maintaining annulus pressures below 1 Pa along with other receiver problems and maintaining annulus pressures below 1 Pa along with other receiver problems (black chrome degradation) that reduced the performance of the collector. Analyses of the test results show that a vacuum in the annulus of the receiver assembly can significantly increase the amount of energy collected daily by at least 13% depending upon the reflector trough and tracking capabilities of the collector design. The problem associated with the current receiver are described and a modified passive vacuum design intended to correct the problems is presented. Test results will determine whether the value of the additional energy collected is greater than the cost of achieving the vacuum. DOE

N80-11583# Department of Energy, Washington, D. C.

UNITED STATES/CANADA ELECTRICITY EXCHANGES

Feb. 1979 233 p refs Prepared in cooperation with Department of Energy, Mines and Resources, Ottawa, Ontario

(DOE/ERA-0053) Avail: NTIS HC A11/MF A01

The United States and Canada have been cooperating in all areas of energy exchange for many years. Electrical energy was chosen to be the focus because substantial means for exchanges offer benefits that have not yet been fully exploited. There may be some bilateral benefits from additional interconnections because of the buffers which they represent against domestic imbalances. After the history of the electricity exchanges between the two countries is reviewed, opportunities and incentives and obstacles and constraints are discussed. The procedures to resolve obstacles and minimize constraints are discussed. DOE

N80-11584# Brookhaven National Lab., Upton, N. Y.

CASE STUDY OF THE BROWNELL LOW ENERGY REQUIREMENT HOUSE, THERMAL STORAGE ANALYSIS

R. Jones, R. Krajewski, and G. Dennehy 1979 15 p refs Presented at Solar Energy Storage Options Workshop, San Antonio, Tex., 18 Mar. 1979

(Contract EY-C-02-0016)

(BNL-25832; Conf-790328-6) Avail: NTIS HC A02/MF A01

An analysis is made of the thermal storage performance of an innovative residence built in the Adirondacks area of New York State by Adirondack Alternate Energy. A detailed case study report of this residence will be issued shortly by Brookhaven National Laboratory. Effective integral thermal storage provided by the exposed interior building structure, serves to keep interior temperature swings within acceptable limits. Additional remote thermal storage, is provided in the form of a large sand bed, with air ducts located below the basement floor slab. The building was instrumented and tested by BNL staff during January, February, and March of 1978, with technical assistance provided by the builder's staff. The thermal storage effects of the remote sand bed and the building materials available for thermal storage within the structure are quantified. The thermal storage performance of the exposed building materials was found to be quite effective. The existing sand bed, however, has a diurnal storage utilization factor of only 8%. Two hypothetical designs are shown which improve the storage bed utilization to 38% for a sand bed with an enhanced duct system 61% for a ducted concrete slab. Other comparisons of these storage beds are also made, including a comparison with a rock bed storage system. DOE

N80-11585# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.

REGIONAL REFERENCE ENERGY SYSTEMS: ELECTRIC UTILITY APPLICATIONS

A. Hermelee Jan. 1979 106 p refs

(Contract EY-76-C-02-0016)

(BNL-50962) Avail: NTIS HC A06/MF A01

The Reference Energy Systems (RES) projection methodology is reformulated in order to apply the format to an electric utility region. The system's approach, incorporating all resources, technologies and uses of energy, allows a utility to assess the impact of alternate technologies and policies across the entire energy system. Demand patterns for 25 end-use demand categories within the residential, commercial, industrial, and transportation sectors are developed for a base case scenario representing reasonable energy use patterns derived in a consistent manner by applying engineering techniques to the best available information. The impact of a new technology in terms of resource consumption is evaluated by modifying the energy flow paths to incorporate the new technology. Alternate paths through the network reflect the substitutability of resources and technologies for one another. DOE

N80-11586# Argonne National Lab., Ill.
DOE HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS PROJECT
J. M. Calm 1979 17 p refs Presented at Heat Pump Technol., Inform. Exchange Meeting, Gaithersburg, Md., 7 Mar. 1979
(Contract W-31-109-eng-38)
(CONF-790362-1) Avail: NTIS HC A02/MF A01

The development of centralized, distributed, and cascaded heat pump centered integrated community energy systems using both waste and natural heat is discussed. These systems show promise for cost reduction, increased reliability, and avoidance of adverse environmental effects in providing process and space heating and cooling. K.L.

N80-11587# Argonne National Lab., Ill.
WORLD ENERGY DATA SYSTEM (WENDS)
W. E. Lareau 1979 45 p refs Presented at the Spring Meeting of the Assoc. of System 2000 Users for Tech. Exchange (ASTUTE), Austin, Tex., 3 Apr. 1979
(Contract W-31-109-eng-38)
(CONF-790461-2) Avail: NTIS HC A03/MF A01

The storage of preformatted textual information in a completely user oriented data base, the World Energy Data System, is discussed. The system allows qualified users online access to nonclassified management level data on worldwide energy technology and research and development activities. WENDS transmits up-to-date information on foreign energy technology and research and development programs to DOE program divisions, the Congress, and other U.S. Government officials going abroad. The WENDS concept is described and the method storing and retrieving the textual information is discussed. DOE

N80-11588# Bituminous Coal Research, Inc., Monroeville, Pa.
GAS GENERATOR RESEARCH AND DEVELOPMENT: BI-GAS PROCESS Interim Report, Jul. 1977 - 30 Jun. 1978
Sep. 1978 254 p refs Prepared in cooperation with Phillips Petroleum Co. Sponsored in part by the American Gas Assoc.
(Contracts EX-76-C-01-1207; EF-77-C-01-1207)
(FE-1207-49; BCR-L-919) Avail: NTIS HC A12/MF A01

Work continued on the evaluation of fluidized-bed methanation catalysts at both the bench-scale and PEDU-scale levels. In addition, assistance has been given in planning, acquisition, and assessment of the BI-GAS pilot plant operation data. Bench-scale studies included six standard life tests to evaluate 22 new fluidized-bed methanation catalysts, and one life test of samples of catalyst from PEDU Test No. 27 to determine, if possible, a reason for the decreased activity of the catalyst during the PEDU test. Of the 22 new catalysts, only one showed sufficiently high activity at normal operating temperatures to justify consideration as a PEDU test candidate; a PEDU-size sample of this catalyst was ordered. A new clear-plastic model of the PEDU methanator was constructed for the purpose of studying heat-transfer characteristics within the methanator. Initial tests agreed substantially with PEDU data and indicated that the axial tube location gave better heat transfer than the nonaxial location. DOE

N80-11589# Department of Energy, Seattle, Wash.
INCREASED ENERGY FROM BIOMASS: 1985 POSSIBILITIES AND PROBLEM. WORKING PAPERS FOR PLANNERS
1978 202 p From Pacific Northwest Bioconversion Workshop, Portland, Oreg., 24-26 Oct. 1978; Sponsored in cooperation with the Energy Offices of Alaska, Idaho, Montana, Oregon and Washington, U. S. Forest Service and Oregon State Univ.
(RLO-788-5; Conf-7810132) Avail: NTIS HC A10/MF A01

Summaries, together with charts and data in some cases, of the talks given by panelists to the Conference are compiled. The first four sessions examined current agricultural and peat applications with emphasis on wood use. The resource base for agricultural wastes, peat, and wood was evaluated. In the fifth session the barriers and constraints on the use of biomass as an energy source were identified and some possible solutions suggested. The sixth session consisted of work groups on the production of gaseous and liquid fuels, utility applications of biomass and impacts, residential and small scale applications, and biomass supply systems. Extensive summaries were provided of the discussions of each work group; these included recommendations on private and public actions necessary to foster the use of biomass for energy. DOE

N80-11590# Department of Energy, Washington, D. C.
DEPARTMENT OF ENERGY FOSSIL ENERGY EQUIPMENT DEVELOPMENT PROGRAMS
J. L. Powell, W. R. Williams (ORNL), T. K. Lau, and H. T. Jones Apr. 1979 13 p refs Presented at AICE Meeting, Houston, Tex., 1 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790405-14) Avail: NTIS HC A02/MF A01

Design, construction, and operation of synthetic fuel processing plants in the near future must consider equipment requirements to make such operations economically feasible and sound. The Department of Energy's approach is to use as much available equipment as practical, to modify and qualify equipment which is not expected to perform acceptably in its standard configuration, and to develop new equipment only if no current capability or acceptable alternative exists. Approaches, philosophy, goals, and implementation of fossil energy equipment development programs are discussed. Some results of a recent survey of industrial coal conversion equipment capabilities are presented as an example of current equipment, state-of-the-art and equipment development needs. DOE

N80-11591# Sandia Labs., Albuquerque, N. Mex.
COMPOSITION STABILITY AND DEGRADATION PRODUCTS OF SELECTED MATERIALS FOR SOLAR HEATING AND COOLING
C. Arnold, Jr. and R. E. Trujillo Mar. 1979 36 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0681) Avail: NTIS HC A03/MF A01

The composition, stability and thermal degradation products of a variety of structural plastics, heat transfer fluids, thermal storage media and sealants, which have been proposed for use in solar heating and cooling applications, were either defined generically by analysis or obtained by surveying the literature. This information will be used to aid in the assessment of the environmental impact of these materials. By gas chromatography-mass spectrometry (GCMS), Beta-phenylnaphthylamine, a suspected carcinogen, was tentatively identified as a component in the heat transfer fluid, UCON. In addition, aromatic components which might be toxic were detected in all of the heat transfer fluids that were derived from petroleum sources. By TGA (thermogravimetric analysis), it was found that polysulfide, Neoprene, poly(vinyl chloride) and poly(vinyl fluoride) were the least stable solar heating and cooling materials. In the event of a solar system failure, these materials would be expected to thermally degrade and evolve such toxic substances as H2S, HCl and HF. Other solar heating and cooling materials were found to be more thermally stable and hence should not outgas if the solar system fails. DOE

N80-11592# Los Alamos Scientific Lab., N. Mex.
DEVELOPMENT OF INTEGRATED THERMIONIC CIRCUITS FOR GEOTHERMAL HIGH-TEMPERATURE APPLICATIONS
J. Byron McCormick and D. Wilde 1979 6 p refs Presented at 20th Ann. Logging Symp., Tulsa, Okla., 3 Jun. 1979
(Contract W-7405-eng-36)
(LA-UR-79-723; Conf-790605-1) Avail: NTIS HC A02/MF A01

A new integrated thermionic device capable of withstanding ambient temperatures in excess of 500 C is reported. The evolution of the integrated thermionic circuit (ITC) is discussed and a set of practical device design and performance equations are demonstrated. DOE

N80-11593# Department of Energy, Washington, D. C. Economic Regulatory Administration.
STANDBY CONSERVATION PLAN NO. 2: EMERGENCY BUILDING TEMPERATURE RESTRICTIONS. ECONOMIC ANALYSIS
Feb. 1979 39 p refs
(DOE/ERA-0047) Avail: NTIS HC A03/MF A01

The emergency building temperature restrictions plan is

intended to be implemented in the event of a petroleum supply interruption or to satisfy the obligations of the United States under the International Energy Program. The economic impact of the measure was analyzed by assuming that the measure was implemented during 1980-1981 in a hypothetical petroleum shortfall of 15%. The plan is designed to reduce energy consumption by placing restrictions on thermostat settings for heating, cooling, and hot water in commercial, industrial, and public buildings. Specifically, the plan would mandate a maximum thermostat setting of 65 F for space heating, a minimum setting of 80 F for space cooling, and maximum setting of 105 F for hot water. Hotels and motels, hospitals, and areas of buildings where specific temperatures are required to maintain special equipment or supplies are exempt. Also exempt is hot water used for dishwashing and other uses where health codes require higher temperatures for sanitation. Effects of the measure on worker comfort and productivity are discussed in the appendices. DOE

N80-11594# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.
REGENERATIVE FLYWHEEL ENERGY STORAGE SYSTEM
E. L. Lustenader, I. H. Edelfelt, D. W. Jones, A. B. Plunkett, E. Richter, and F. G. Turnbull 1979 30 p refs
(Contract W-7405-eng-48)
(UCRL-13982) Avail: NTIS HC A03/MF A01

The current status of a program to develop and evaluate a regenerative flywheel energy storage system is described. The system was designed for a battery/flywheel electric vehicle in the 3000 pound class. DOE

N80-11595# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
INEL GEOTHERMAL ENVIRONMENTAL PROGRAM Annual Report, 1978
Susan G. Spencer, J. F. Sullivan, and N. E. Stanley Apr. 1979 65 p refs
(Contract EY-76-C-07-1570)
(TREE-1340) Avail: NTIS HC A04/MF A01

The monitoring and research efforts were conducted to characterize the beneficial and detrimental impacts resulting from the development of moderate temperature geothermal resources in the Raft River Valley. DOE

N80-11596# Los Alamos Scientific Lab., N. Mex.
NIGHT STORAGE AND BACKUP GENERATION WITH ELECTROCHEMICAL ENGINES
G. R. B. Elliott and N. E. Vanderborgh 1978 15 p Presented at Solar Thermal Test Facilities Users Assoc. Meeting, Golden, Colo., 11 Apr. 1978
(Contract W-7405-eng-36)
(LA-UR-78-1149; Conf-780447-1) Avail: NTIS HC A02/MF A01

The design of Li-I2 electrochemical engines which both store and generate electric power is described. The conversion of heat energy to electrical energy in the electrochemical engines is examined. The laboratory performance of electrochemical engines based on the Li-I2 chemical system is discussed. The calculations for the expected performance of particular Li-I2 electrochemical engines used for storage and for each solar to electric conversion path are presented. A.W.H.

N80-11597# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
BIOLOGICAL EVALUATION OF DEVICES USED FOR ENTRAINMENT AND IMPINGEMENT LOSSES AT THERMAL POWER PLANTS
G. F. Cada and A. T. Szluha 1978 53 p refs Presented at the Intern. Symp. on the Environ. Effects of Hydraulic Eng. Works, Knoxville, Tenn., 12 Sep. 1978 Sponsored in part by NUREG and EPA
(Contract W-7405-eng-26)
(CONF-7809109-1) Avail: NTIS HC A04/MF A01

A preliminary survey of fish protection devices either in use or proposed for water intake structures was conducted for the purpose of assessing their potential for reducing impingement and entrainment. All the designs examined fit into two basic categories: behavioral screening devices systems and physical screening systems. The behavioral screening devices rely upon the ability of fish to sense artificial stimuli and respond by swimming away from hazardous areas. These systems are of little or no value in protecting planktonic fish eggs, larvae, and disoriented, heat-shocked, or lethargic adult fishes. Many of the physical screening devices, on the other hand, require the impingement of organisms against a screen before they can be removed from the intake system, thus subjecting survival. Some of the designs incorporate both behavioral and physical screening concepts. The design features and status of biological testing is discussed for each device, and an evaluation of their fish protection potential is presented. DOE

N80-11598# Midwest Research Inst., Golden, Colo.
PROCEEDINGS: SOLAR THERMAL POWER USER REVIEW PANEL MEETING
Mar. 1979 33 p Conf. held 1-2 Mar. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-69-221) Avail: NTIS HC A03/MF A01

Solar Energy Research Institute presentations on (1) the R&D mission in Solar Thermal technology; (2) TID management and organization; and (3) target audience characteristics are reviewed. Synopses of discussions on target audience needs are included. DOE

N80-11599# Ocean Data Systems, Inc., Monterey, Calif.
OTEC THERMAL RESOURCE REPORT FOR CARIBBEAN SEA PLANT SHIP 13-15 DEGREES N 75-80 DEGREES N
W. A. Wolff May 1979 41 p refs
(Contract ET-78-C-01-2898)
(HCP/T2898) Avail: NTIS HC A03/MF A01

A large and consistent thermal resource which exists in the area between 13-15 deg North latitude and 75-80 deg West longitude, was studied for possible use by a plant ship. The area is primarily in the Colombian Basin of the Caribbean Sea. The average annual delta T (surface temperature minus temperature at depth) for the area at 1000 meters is 22.4 C. At 650 meters, an adequate delta T exists, with no month of the year having a mean delta T less than 19 C. The total variability of temperature at all depths in this Caribbean area is small. Below 1000 meters, the total variation is extremely small. The area has a good mixed layer at all times of the year. It is occasionally exposed to strong winds from hurricanes. Currents generally show the same general pattern throughout the year with a predominant flow toward the west or northwest at average speeds of 40-50 cm/sec. DOE

N80-11600# Ocean Data Systems, Inc., Monterey, Calif.
OTEC THERMAL RESOURCE REPORT FOR WESTERN COAST MEXICO
W. A. Wolff May 1979 44 p refs
(Contract ET-78-C-01-2898)
(HCP/T2898) Avail: NTIS HC A03/MF A01

The site chosen for study off the western coast of Mexico between 20 deg 23 deg North latitude, 105 deg 110 deg West longitude has a temperature difference resource which is more than adequate for potential OTEC use. The annual mean delta to 1000 meters is 20.9 C. An annual mean delta T of 20.0 C is available at 800 meters. The monthly mean delta T for the coldest month of the year is 17.2 C; at 800 meters while there is some variation in the monthly mean temperature difference, even the coldest month is adequate. The mixed layer depth is very shallow throughout the entire year. Storms are a problem for this area between May and November. Low sea and swell predominate throughout the year. The surface currents are generally weak to moderate with some variation in direction during the year. The continental shelf is fairly wide for most of the region making the distance to shore from depths of 1000 meters somewhat large. There is one bay from which deep water can be reached within 5 kilometers. DOE

N80-11601# Department of Energy, Washington, D. C. Energy Information Administration.
RESIDENTIAL SECTOR ENERGY FORECASTS, NATIONAL LEVEL FOR 1978-ELECTRICITY, NATURAL GAS, NUMBER TWO FUEL OIL AND PROPANE
P. DonVito and H. Walton Mar. 1979 23 p refs
(DOE/EIA-0102/50) Avail: NTIS HC A02/MF A01

Methods and results of estimating the average 1978 price of fuels used in the residential sector are given. Average (as opposed to marginal) prices were requested and are given for electricity, natural gas, No. 2 fuel oil, and propane. The projected 1978 average fuel prices resulting from the analysis are: electricity, 4 cents/kWh; natural gas, 27.5 cents/therm; No. 2 fuel oil, 49.2 cents/gallon; and propane, 44.9 cents/gallon. Regional and seasonal variations are not discussed here. DOE

N80-11602# Midwest Research Inst., Kansas City, Mo.
STATUS OF INFORMATION FOR CONSUMERS OF SMALL WIND ENERGY SYSTEMS
P. Weis Feb. 1979 19 p refs Presented at the Symp. on Commercialization of Solar and Conserv. Technol., Miami Beach, Fla., 11 Dec. 1978
(Contract EG-77-C-01-4042)
(SERI/TP-51-158; Conf-781235-3) Avail: NTIS HC A02/MF A01

Research efforts, existing information sources, and ongoing work to improve data necessary for potential consumers of small wind energy conversion systems are presented. DOE

N80-11603# Monsanto Research Corp., Dayton, Ohio.
ENERGY STORAGE FOR SOLAR AIR CONDITIONING APPLICATIONS UTILIZING A FORM-STABLE, HIGH DENSITY POLYETHYLENE PELLET BED
R. B. Whitaker, G. H. Jenkins, G. L. Ball, and I. O. Salyer (Dayton Univ. Res. Inst.) 1979 10 p refs Presented at the Solar Energy Storage Options Workshop, San Antonio, Tex., 18 Mar. 1979
(Contract EY-76-C-04-0053)
(MLM-2598(OP); Conf-790328-1) Avail: NTIS HC A02/MF A01

The results obtained from a cost effectiveness comparison of three different methods of crosslinking high density polyethylene (HDPE) to make it a form-stable, useful thermal energy storage (TES) material are presented in some detail. In addition, the projected costs of a proposed HDPE-liquid thermal transfer system are compared to those of other liquid and air thermal transfer TES systems operative in the same 100 to 150 C range. DOE

N80-11604# Stanford Linear Accelerator Center, Calif.
HYDROGEN-ELECTRIC POWER DRIVES
F. F. Hall Oct. 1978 10 p
(Contract EY-76-C-03-0515)
(SLAC-PUB-2203; Conf-781214-2) Avail: NTIS HC A02/MF A01

Hydrogen-electric power drives consist of most or all of the following: chilled hydrogen gas tank, liquid oxygen tank, a bank of fuel cells, dc/ac inverter, ac drive motors, solid state ac speed control, dc sputter-ion vacuum pumps, steam turbine generator set and steam condenser. Each component is described. Optional uses of low pressure extraction steam and warm condensate are listed. Power drive applications are listed. Impact on public utilities, fuel supplies, and users is discussed. DOE

N80-11605# Battelle Pacific Northwest Labs., Richland, Wash.
USER MANUAL FOR GEOCITY: A COMPUTER MODEL FOR GEOTHERMAL DISTRICT HEATING COST ANALYSIS
H. D. Huber, C. L. McDonald, and S. C. Schulte Oct. 1978 200 p refs
(Contract EY-76-C-06-1830)
(PNL-2742) Avail: NTIS HC A09/MF A01

A computer model called GEOCITY was developed to systematically calculate the potential cost of district heating using hydrothermal geothermal resources. GEOCITY combines climate, demographic factors, and heat demand of the city, resource conditions, well drilling costs, design of the distribution system, tax rates, and financial factors into one systematic model. The GEOCITY program provides the flexibility to individually or collectively evaluate the impact of different economic and technical parameters, assumptions, and uncertainties on the cost of providing district heat from a geothermal resource. Both the geothermal reservoir and distribution system are simulated to model the complete district heating system. GEOCITY calculates the unit cost of energy and the unit cost of heat for the district heating system based on the principle that the present worth of the revenues will be equal to the present worth of the expenses including investment return over the economic life of the distribution system. DOE

N80-11606# Fletcher (A. L.) and Associates, Gainesville, Fla.
ANALYSIS OF FINANCIAL PROGRAMS FOR ENERGY CONSERVATION: MARKET SIMULATION (PENETRATION) MODEL
G. S. Maddala, J. W. Milliman, and R. B. Roberts Aug. 1978 273 p refs
(Contract EC-76-C-01-8662)
(HCP/M8662-1) Avail: NTIS HC A12/MF A01

A simulation model was developed to evaluate the effects of Federal financial-incentive programs. Specifically the model was developed for two industries: primary metals and stone, clay, and glass. The model is designed to be a link between existing macro models of the economy and micro engineering models. The model is also designed as a prototype that could be easily adapted to a variety of industries. The model, as currently developed, performs the following major functions: (1) evaluates the impact of different financial incentive programs on the rate of market penetration of energy-saving technologies; (2) estimates the energy saved over-time because of these programs; (3) estimates the change in energy efficiency of the capital stock because of these programs; (4) estimates the value of the energy saved and the cost to the government of the program; and (5) calculates the social benefits and costs of the program. DOE

N80-11607# Fluor Engineers and Constructors, Inc., Irvine, Calif.
HEBER GEOTHERMAL DEMONSTRATION POWER PLANT Interim Report, Aug. 1977 - Jan. 1978
Aug. 1978 67 p refs Sponsored in part by San Diego Gas and Electric Company
(EPRI Proj. 580-2)
(EPRI-ER-863; IR-1) Avail: NTIS HC A04/MF A01

The work performed from August 1977 through January 1978 pertinent to the design of the demonstration plant is reported. The Heber project objective is to design, construct and operate a power plant to produce a net power output of 45 MW/sub e/, deriving energy from a low-salinity, moderate temperature (360 F, 182 C) brine heat source available from the Heber geothermal reservoir. A binary cycle conversion system employs a light aliphatic hydrocarbon mixture to derive heat from the brine supply, through heat exchangers, and drive the turbine-generator to produce power. Power output will be distributed to California's Imperial Valley. DOE

N80-11608# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE DEVELOPMENT. PHASE 1: DESIGN REQUIREMENTS
E. C. Snow and R. W. Zocher Sep. 1979 24 p refs
(Contract W-7405-eng-36)
(LA-7385-SR) Avail: NTIS HC A02/MF A01

Studies were performed to determine the necessary design requirements for a PuO2 General Purpose Heat Source (GPHS). Systems and missions applications, as well as accident conditions, were considered. The results of these studies, along with the recommended GPHS design requirements, are presented and discussed. DOE

N80-11609# Addis Translations International, Portola Valley, Calif.
CONVERSION OF RADIANT ENERGY INTO CHEMICAL ENERGY
G. Calzaferri Nov. 1978 44 p refs Transl. into ENGLISH from Chimia, Switzerland, v. 32, no. 7, Nov. 1978 p 241-253
(UCRL-Trans-11427) Avail: NTIS HC A03/MF A01

The conversion of light into chemical energy as well as the conversion of chemical energy into light leads to exciting speculations and experiments. Reversible photoredox reactions appear to be the most promising chemical system for converting solar energy into chemical or electrochemical energy. Finding selective electrode material in photogalvanic cells is one of the problems to be solved. Selective electrode material for Fe(+3)/sub sq/Fe(+2)/sub sq was found in the thionine/iron system as well as in the iodine/iron system. Attention should now be focused on reversible two or more photon processes at low light intensities

because cleavage of water in the visible region cannot be done with one photon. DOE

N80-11610# Argonne National Lab., Ill.
CHEMICAL ENGINEERING DIVISION BASIC ENERGY SCIENCES RESEARCH Report, Jul. 1976 - Sep. 1977
1978 112 p refs
(Contract W-31-109-eng-38)
(ANL-78-42) Avail: NTIS HC A06/MF A01

Studies in basic energy science covered many different activities, nearly all of which were designed to gain information required for a better understanding of systems important to national needs in energy and environment. Studies of associating gases included measurements of thermal conductivities and basic molecular orbital calculations. Raman spectroscopy and spectrophotometry were used to determine thermodynamic and spectroscopic data on salt vapor complexes. Polarized Raman spectra of As2S3 thin films and vapors were recorded. Halogenation of lanthanide oxides with aluminum chloride allowed the separation of the resultant chloride complexes by vapor transport. Electrochemical titrations were used to obtain the solubility product of iron sulfide in molten LiCl-KCl eutectic. Solubility products of eleven sulfides in the same eutectic mixture were calculated. Galvanostatic techniques were used to study metal deposition/dissolution reactions in molten salts. Activity-coefficients of lithium in lithium-lead alloys were determined electrochemically; phase diagrams of ternary alloys of Li-Al-Mg and Li-Ca-Mg were computed. Thermodynamic studies are being made of the sorption of hydrogen by Li-Al and Li-Pb alloys.DOE

N80-11611# Eidgenoessisches Institut fuer Reaktorforschung, Wuerenlingen (Switzerland).
ON THE BEHAVIOUR OF HELIOSTATS IN THE EXTREME WINTER CLIMATE OF THE SWISS MOUNTAINS
M. Real and P. Kesselring 1978 20 p refs Presented at the Symp. on Solar Thermal Power Stations, Koeln, Germany, 11 Apr. 1978
(AED-Conf-78-212-001; Conf-780418-2) Avail: NTIS HC A02/MF A01

A baby heliostat of 0.25 sq m mirror surface was investigated for reflection losses due to icing phenomena on the mirror surface. The test facility and the mechanically guided heliostat are described. A comparison of the heliostat reflected and direct solar radiation is discussed. A.W.H.

N80-11612# Transportation and Economic Research Associates, Inc., Arlington, Va
DISAGGREGATING PIES FUEL FORECASTS, VALIDATING PIES TRANSPORTATION MODEL DATA BASE, AND OTHER TECHNICAL SERVICES
15 Sep. 1978 84 p
(Contract EC-77-C-01-8578)
(TID-29000) Avail: NTIS HC A05/MF A01

Three research tasks concerned with modifications and/or alterations to the PIES (Project Independence Evaluation System) and one auxiliary research task are reported. The first task, a modification to the transportation data base for petroleum refining regions, was necessitated by a proposed change of the present seven refining districts to ten refining districts. Five of the Standard Tables on transportation costs required changes. Tariffs and route descriptions are given in interregional pipeline rates for crude oil and petroleum products. Pipeline tariffs and tanker costs for distribution of Alaskan oil to PIES refining regions are tabulated. In the second task the structure of the coal transportation submodel in PIES was changed by building a simplified transshipment network which makes it possible to easily track coal from the mine to the point of use. The third task is a brief description of natural gas rates and rate making practices in the U.S. The fourth task analyzes differences in actual wholesale prices in various other locations in a region (as opposed to the PIES centroid) with respect to the differences in transportation costs. DOE

N80-11613# Sandia Labs., Albuquerque, N. Mex. Midtemperature Solar Systems Test Div.
MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY (MSSTF) PROJECT TEST RESULTS: PHASE 4A MSSTF SYSTEM OPERATION
Thomas D. Harrison and William H. McCulloch Nov. 1978 53 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1088) Avail: NTIS HC A04/MF A01

The results of testing the Department of Energy's Midtemperature Solar Systems Test Facility (MSSTF) at Sandia Laboratories, Albuquerque, New Mexico are summarized. The system is a dispersed power system that collects solar energy and supplies both the electrical and thermal energy demands of a representative load. Testing was done between July 1976 and March 1978. The Phase IVA MSSTF studied consists of: (1) a 200-m sq m (2160-sq ft) east-west parabolic trough collector field subsystem, which collects a measured 431-kWh thermal on a typical winter day and as estimated 483 kWh on a typical summer day; (2) a high-temperature thermocline storage subsystem, capable of storing 278-kWh thermal energy in Therminol 66 between 240 C and 310 C; (3) fluid-transfer equipment, including piping, pumps, and valves; (4) a prime-mover subsystem (toluene heat exchanger and turbine/generator) to convert thermal energy to electrical energy; and (5) a control and data-acquisition system. A brief description of each of these elements is given, and test results are reported. DOE

N80-11614# California Univ., Berkeley. Lawrence Berkeley Lab.
ENERGY CONSERVATION: POLICY ISSUES AND END-USE SCENARIOS OF SAVINGS POTENTIAL PART 3: POLICY BARRIERS AND INVESTMENT DECISIONS IN INDUSTRY
Sep. 1978 54 p
(Contract W-7405-eng-48)
(LBL-7896-Pt-3) Avail: NTIS HC A04/MF A01

Industrial decision making was investigated with respect to energy conservation. It was concluded that government policy could be formulated to encourage conservation investments, but government intervention should be limited to those situations where it is both necessary and likely to be effective. To assist policy makers in understanding the industrial decision making process and recognizing the factors which prevent a measure from being adopted, a methodology is developed that can be applied to most conservation measures in all industrial subsectors. The methodology is summarized in two flow charts and a matrix. DOE

N80-11615# Institute of Gas Technology, Chicago, Ill.
INFLUENCE OF ELECTROLYTE COMPOSITION ON ELECTRODE KINETICS IN THE MOLTEN CARBONATE FUEL CELL
P. Ang and A. F. Sammells 1978 30 p refs Presented at the 2d Intern. Symp. on Molten Salts, Pittsburgh, Pa., 15-20 Oct. 1978; sponsored by the Electrochem. Soc., Inc.
(Contract EM-78-C-03-1735)
(CONF-781063-2) Avail: NTIS HC A03/MF A01

Electrode Kinetics for fuel oxidation on nickel and cobalt electrodes is discussed for three selected molten carbonate mixtures. Activation kinetics under the probable mixed-control conditions present in the electrochemical half-cell were determined using a potential step technique. With all melts, the highest exchange current values were found on nickel anodes, and the highest of these values were found for the melt comprised of 43.5 mole percent Li2CO331.5 mole percent Na2CO3-25 mole percent K2CO3. For this ternary melt the exchange current density on nickel varied from 78 mA/sq cm for intermediate-Btu fuel to 22 mA/sq cm for low-Btu fuel at 650 C. The exchange current density was found to have a reaction order of around 0.25 for hydrogen, carbon dioxide, and water. Electrochemical performance on the two anode materials in the three melts is discussed, and a tentative reaction mechanism for the oxidation reaction is suggested. DOE

N80-11616# Los Alamos Scientific Lab., N. Mex.
ENERGY SAVINGS FOR A SOLAR HEATED AND COOLED BUILDING THROUGH ADAPTIVE OPTIMAL CONTROL
D. R. Farris and James L. Melsa Nov. 1978 9 p refs Presented at IEEE Conf. on Decision and Control, San Diego, Calif., 10 Jan. 1979 Prepared in cooperation with Notre Dame Univ.
(Contract W-7405-eng-36)
(LA-UR-78-2986; Conf-790105-1) Avail: NTIS HC A02/MF A01

The applicability of adaptive and optimal control techniques to the control of heating, ventilating, and air conditioning systems of solar heated and cooled buildings is described. The suitability of optimal and adaptive concepts is discussed and the selected approach is explained. An integral quadratic cost functional to define optimal performance and an identification process to produce a linearized building model are discussed. The building model is described and heating system simulations of three versions of the adaptive optimal controller are reported along with a simulation of a conventional controller for comparison. DOE

N80-11617# Midwest Research Inst., Golden, Colo.
RESEARCH OVERVIEW OF BIOLOGICAL AND CHEMICAL CONVERSION METHODS AND IDENTIFICATION OF KEY RESEARCH AREAS FOR SERI Final Report
T. A. Milne, John S. Connolly, Robert E. Inman, Thomas B. Reed, and Michael Seibert Sep. 1978 75 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-33-067) Avail: NTIS HC A04/MF A01

The current and future research areas of the biological and chemical conversion branch is presented. Energy and petrochemical substitutes from biomass, thermochemical conversion, and photoconversion are research areas examined. DOE

N80-11618# California Univ., Livermore. Lawrence Livermore Lab.
MATERIALS PROGRAM FOR FIBER COMPOSITE FLYWHEELS
J. A. Rinde 10 Oct. 1978 13 p refs Presented at 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978
(Contract W-7405-eng-48)
(UCRL-81724; Conf-781046-9) Avail: NTIS HC A02/MF A01

A rubberized epoxy resin that offers improved fracture toughness and suitable performance at moderately elevated temperatures (up to 70 C) and six epoxy resins for service at 150 C were evaluated. In addition, the rubberized epoxy resin was used as a matrix in Kevlar 49 composites and engineering design data were generated. Stress rupture tests were initiated on E-glass composites at load levels of 60% to 85% of short term strength. Dynamic fatigue tests on Kevlar 49 composites in the tension-tension mode and fatigue tests on a Kevlar 49 composite ring specimen at 50% to 75% ultimate strength were begun. DOE

N80-11619# Argonne National Lab., Ill.
PRELIMINARY MATERIALS ASSESSMENT IN SOLAR DEMONSTRATION SYSTEMS
C. F. Cheng Nov. 1978 29 p refs Presented at the ASME Energy Technol. Conf., Houston, Tex., 5 Nov. 1978
(Contract W-31-109-eng-38)
(ANL/EES-CP-30; Conf-781112-8) Avail: NTIS HC A03/MF A01

Materials performance in solar demonstration systems is assessed from published literature and service experience. The solar demonstration systems and the materials used in the collector and transport systems are summarized. DOE

N80-11620# Chalmers Univ. of Technology, Goteborg (Sweden). Institutionen foer Fysik.
SPECTRALLY SELECTIVE SURFACES WITH COATINGS COMPRISED OF ULTRAFINE METAL PARTICLES
C. G. Granqvist 1978 15 p refs Presented at the Symp. on Solar-Thermal Power Stations, Cologne, 12 Apr. 1978
(AED-Conf-78-212-004; Conf-780425-7) Avail: NTIS HC A02/MF A01

Efficient photothermal conversion of solar energy requires high absorption at wavelengths lambda > lambda/sub c/ and low absorption at lambda > lambda/sub c/, where lambda/sub c/ is approximately 2 micro m. Such spectrally selective surfaces can be prepared by coating metal plates with films consisting of ultrafine metal particles dispersed in an insulating matrix. Gas evaporated Cr particles with diameters approximately 10 nm were used. Spectrophotometry in the range 0.3 < lambda 25 micron m displayed good spectral selectivity. The parameters governing the position of lambda/sub c/ were determined. The crucial importance of the shape of the particles was documented, and, in general, increased eccentricity shifted lambda/sub c/ toward larger wavelengths. A similar shift was obtained for nonhomogeneous spheres whose dielectric core size was enlarged. DOE

N80-11621# Department of Energy, Washington, D. C.
INTERNATIONAL COAL TECHNOLOGY SUMMARY DOCUMENT
Dec. 1978 113 p refs Prepared in cooperation with TRW, Inc., McLean, Va.
(Contract EX-76-C-10-3885)
(DOE/PE-0010; HCP/P3885) Avail: NTIS HC A06/MF A01

The status of coal technologies expected to be available for commercial application by 1990 is reviewed. Technologies discussed include direct combustion using flue gas desulfurization, fluidized bed combustion, gasification, liquefaction, and advanced power cycles. Coal mining and transportation are also reviewed. Social, environmental, safety, and health constraints on coal use are considered. K.L.

N80-11622# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
LATERAL AND TILT WHIRL MODES OF FLEXIBLY MOUNTED FLYWHEEL SYSTEMS
C. W. Bert and T. L. C. Chen Dec. 1978 36 p refs Presented at the 49th Shock and Vibration Symp., Washington, D. C., 17-19 Oct. 1978 Prepared for Sandia Labs.
(Contract EY-76-C-04-0789)
(SAND-78-7070; OU-AMNE-78-5; Conf-7810154-1) Avail: NTIS HC A03/MF A01

High performance, composite material flywheel systems were driven by an air turbine at the Sandia Livermore spin test facility. An analysis of the systems considering six degrees of freedom was applied to two versions of a specific design. DOE

N80-11623# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
WHIRLING RESPONSE AND STABILITY OF FLEXIBLY MOUNTED, RING-TYPE FLYWHEEL SYSTEMS
T. L. C. Chen and C. W. Bert Nov. 1978 122 p refs
(Contract EY-76-C-04-0789)
(SAND-78-7073; OU-AMNE-78-6) Avail: NTIS HC A06/MF A01

Rim type composite material flywheels are examined. Free whirling, stability, and forced whirling are examined for these fly-wheel systems. In the free whirling analysis, predicted critical speeds are encountered in the design operating speed range. Practical ways to increase such critical speeds are suggested. Effects of material internal damping on the stability of the system are discussed. DOE

N80-11624# Argonne National Lab., Ill.
UNDERGROUND PUMPED HYDRO STORAGE: AN OVERVIEW
S. W. Tam, C. A. Blomquist, and G. T. Kartsounes 1978 13 p refs Presented at the 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978
(Contract W-31-109-eng-38)
(CONF-781046-1) Avail: NTIS HC A02/MF A01

The status of underground pumped hydro storage (UPHS) for electric utility peaking and energy storage applications is reviewed. The salient features of major recent studies are reviewed. Turbomachinery options and advances in high head pump/turbines are discussed. The effect of head, capacity, turbomachinery unit size and type, and other performance variables on the cost of a UPHS plant are presented. Market potential, siting criteria, lower reservoir construction, and geological related issues are addressed. The environmental impact of a UPHS plant is reduced from comparable facilities, and these issues and other safety concerns are presented. DOE

N80-11625# Argonne National Lab., Ill. Energy and Environmental Systems Div.
EVALUATION OF TURBOMACHINERY FOR COMPRESSED AIR ENERGY STORAGE PLANTS
George T. Kartsounes and Choong S. Kim 1978 11 p refs Presented at Mech. and Magnetic Energy Storage Contractors' Inform. Exchange Conf., Luray, Va., 24-26 Oct. 1978

(Contract W-31-109-eng-38)
(CONF-781046-6) Avail: NTIS HC A02/MF A01

Turbomachinery options for compressed air energy storage plants are presented. The plant is divided into four subsystems: a turbine system, compressor system, motor/generator, and an underground air storage reservoir. Plant performance is presented in terms of five parameters: specific air flow rate, specific heat rate, specific storage volume, specific compression rate, and overall plant efficiency. The capital and operating costs of the plant as a function of the turbomachinery options are presented. DOE

N80-11626# Williams (O. G.) and Skaggs (R. L.), Las Vegas, Nev.
SOLAR PARABOLIC TROUGH FORMING PROCESS Final Report
O. G. Williams and R. L. Skaggs 31 May 1978 58 p refs
(Grant EG-77-G-04-4158)
(ALO-4158-1) Avail: NTIS HC A04/MF A01

A new forming process is presented which exceeds an 8/1 concentration. Expanding on work previously done, many variables were investigated. Using one foot long trough samples, a high degree of slope accuracy was obtained. The forming process eliminated the need for ribs, boxes or other devices now used to maintain the parabolic shape of a solar parabolic shell. The process, in brief, involves (1) alloy aluminum; (2) moments; (3) temperature; (4) time; (5) thickness; (6) bearings; (7) flange angle bend; (8) hardness; (9) lengthwise sag; (10) material flatness; and (11) aperture control. DOE

N80-11627# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MAXIMUM POWER TRACKERS FOR PHOTOVOLTAIC ARRAYS
E. E. Landsman 1977 6 p refs Presented at the 13th IEEE Photovoltaic Specialists' Conf., Washington, D. C., 5-8 Jun. 1978
(Contract EY-76-C-02-4094)
(COO-4094-17) Avail: NTIS HC A02/MF A01

Progress is reported on the following tasks: agriculture applications; Natural Bridges National Monument, rooftop test bed; Chicago Museum of Science and Industry; data management; materials, processes, and testing, and power conditioning and handling. DOE

N80-11628# Argonne National Lab., Ill. Energy and Environmental Systems Div.
DESIGN OPTIMIZATION OF AQUIFER RESERVOIR-BASED COMPRESSED AIR STORAGE SYSTEMS
Frederick W. Ahrens 1978 12 p refs Presented at the Mech. and Magnetic Energy Storage Contractors' Inform. Exchange Conf., Luray, Va., 24-16 Oct. 1978
(Contract W-31-109-eng-38)
(CONF-781046-5) Avail: NTIS HC A02/MF A01

The application of a general compressed air energy storage (CAES) power system design optimization methodology to the class of CAES plants having aquifer air storage reservoirs is discussed. Performance and economic models for the aquifer reservoir, wells, piping, and air compression system are described. Identification of designs which minimize the subsystem power generation cost, while satisfying constraints related to the geology, equipment, and utility load curves are presented. The design specification resulting from the optimization procedure includes: land area to be purchased, well depth, number of wells, well spacing, wellbore diameter, main pipeline diameter, required compressor system power and discharge pressure, and required compression time durations for each day of the week. DOE

N80-11629# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatiale.
THE DYNAMIC RESPONSE OF SOLAR CELLS [COMPORTEMENT ELECTRIQUE DYNAMIQUE DE CELLULES SOLAIRES]
Jean-Pierre Catani Oct. 1978 92 p refs In FRENCH; ENGLISH summary
(CNES-NT-85) Avail: NTIS HC A05/MF A01

The dynamic response of solar generators was studied in relation to the design of power conditioning equipment and for applications in electromagnetic compatibility analyses. A mathematical model of solar cells was developed from impedance measurements performed under various conditions of temperature, charge, and illumination, before and after electron irradiation. This model was compared with that derived from the PN junction theory associated with static measurements. Using this data, an integration method was developed to simulate the dynamic response of a nominally illuminated solar generator under ambient ground conditions. Results show that it is possible to calculate the impedance of a solar cell in function of the frequency up to 1MHz, or for its equivalent circuit given static measurements. Author (ESA)

N80-11630# Gesellschaft fuer Wirtschaftliche Bautechnik m.b.H., Munich (West Germany). Inst. fuer Angewandte Bauforschung.
INVESTIGATION OF THE APPLICABILITY OF TECHNICAL SYSTEMS UTILIZING SOLAR ENERGY FOR THE HEAT SUPPLY OF BUILDINGS Final Report
Josef Franz Holbl and Hannes Krack Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 240 p refs In GERMAN; ENGLISH summary
(Contract BMFT-ET-4056-A)
(BMFT-FB-T-78-48) Avail: NTIS HC A11/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 50,40

The use of solar energy to heat German army barracks was studied. Possibilities for the installation of solar energy systems for heating water and for general heating purposes were considered. Information on available building types, their construction, and intended use, as well as climatic parameters, was compiled. Four categories were analyzed. Results indicate that energy costs can be reduced by between 40 percent to 55 percent in the case of barracks. It is recommended to install four solar heating systems, two in buildings with flat roofs and two in buildings with pitched roofs. It is intended to study the influence of roof type on heating efficiency. Author (ESA)

N80-11631# Stockholm Univ. (Sweden). Dept. of Meteorology.
INTERACTION IN LIMITED ARRAYS OF WINDMILLS: REVIEW OF EARLIER RESULTS FROM A SIMPLE MODEL AND A PRESENTATION OF THE CAPABILITIES OF A DYNAMIC PBL MODEL
Carl Crafoord 27 Mar. 1979 57 p refs Prepared in cooperation with Intern. Meteorol. Inst.
(DM-26) Avail: NTIS HC A04/MF A01

The problem of how closely packed an array of windmills can be erected without unduly interfering with each other is considered. A general technical background for the behavior of a single windmill in a homogeneous flow, together with a list of important parameters for the general performance of a group, is given. Earlier results for neutral stratification are reviewed and presented in a slightly different manner more fully illustrating the trade-off between windmill density and mean efficiency as function of group size. The analogy between plumes and wakes as a basis for a model formulation is reviewed. Preliminary results indicate a variation in mean efficiency of 13% for a group with 80 units, which may correspond to a factor of 2.5 in area coverage. A dynamic one dimensional planetary boundary layer model is presented and redesigned for simulation experiments. Using it, the regeneration of the wind profiles behind a windmill unit is studied for different ambient conditions. Preliminary results indicate a variation of up to a factor of 9 in the rate of regeneration of the profiles. How this data might be considered in a statistical analysis is discussed. Author (ESA)

N80-11632# Austrian Solar and Space Agency, Vienna.
SOLAR ENERGY WITH LATENT HEAT STORAGE: FUNDAMENTALS AND APPLICATIONS [SONNENENERGIE. LATENTSPEICHER. GRUNDLAGEN AND ANWENDUNGEN]
Oct. 1978 78 p refs In GERMAN; ENGLISH summary
(ASSA-10/1978) Avail: NTIS HC A05/MF A01

Solar heating systems are examined in terms of their year-round efficiency. The desirability of storing the surplus of solar energy in summer for the heating period autumn and winter is mentioned. Possible storage schemes, such as water storage, ground storage, and latent heat storage, are examined. It is

shown that water and ground as storage mediums have only small thermal storage capacity and, therefore, need large volumes. As far as latent-heat-storage is concerned, a phase-conversion (solid to liquid) is caused by the supply of heat and this process is reversed again by the withdrawal of heat. Thus, the heat is being stored in the form of conversion energy and the storage volumes become considerably lower since the energy density is much higher. Possible media for latent storage are compiled and their features described. The present state of technology is explained by illustrating applications. Economic aspects and conclusions are presented. Author (ESA)

N80-11633# Environmental Law Inst., Washington, D. C.
SOLAR ACCESS LAW. PROTECTING ACCESS TO SUNLIGHT FOR SOLAR ENERGY SYSTEMS
Gail Boyer Hayes May 1979 173 p refs Sponsored in part by DOE
(Grant HUD-H-8213G)
(PB-296532/5) Avail: NTIS HC A08/MF A01 CSCL 10A

Legal strategies to assure that owners of solar energy systems receive sunlight on their collectors are evaluated. The protection of solar access in developed urban and suburban areas is emphasized. Recommendations are made and conclusions are reached about laws and zoning and land use regulations that offer the best protection of solar rights. K.L.

N80-11634# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKSHOP ASSESSMENT, PHASE 3. ENERGY PROGRAMS Final Report
Aug. 1979 106 p
(Grant EPA-T-900591-03)
(PB-298587/7; EPA-600/8-79-023H) Avail: NTIS HC A06/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

In addition to well-established programs in nuclear engineering, mining, petroleum and natural gas technology and engineering, there are programs in energy conversion, energy engineering and policy, energy conversion and resources, energy resources management, and several others which represent recent innovative approaches to the broad spectrum of energy problems. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-11635 International Institute for Applied Systems Analysis, Laxenburg (Austria).
THE SMEARED CONCENTRATION APPROXIMATION METHOD: A SIMPLIFIED AIR POLLUTION DISPERSION METHODOLOGY FOR REGIONAL ANALYSIS
R. L. Dennis Jul. 1978 78 p refs
(IIASA-RR-78-9) Avail: Issuing Activity

A methodology, the smeared concentration approximation (SCA) method, which allows the inclusion of air pollution dispersion in the long-term analysis of air pollution impact without the direct use of complex, large air pollution models is developed. The SCA method is intended for use in models and analysis concerned with long-term policy analysis and where simulation is one of the important techniques employed. The SCA method centers around short-range transport of dispersion on the urban scale for each of three emission classes: low-level area sources, medium-level point sources, and high-level point sources. A central assumption of the SCA method is that a single spatially averaged exposure for an urban area is a sufficient indicator of air pollution exposure for long-term policy option analysis. Initial validation of the SCA method indicates that the spatially averaged exposure calculated by the means of the SCA dispersion parameters is within 20% of the spatially averaged monitoring data. Author (ESA)

N80-11636# Missouri Univ. - Columbia. Dept. of Civil Engineering.
METAL HYDROXIDES FROM ELECTROPLATING SLUDGE CHARACTERIZATION AND METAL RECOVERY Final Report, 29 Jul. 1977 - 18 Feb. 1978
John T. Novak, Mriganka M. Ghosh, William Knoche, Thomas Clevenger, and Charles Yeh May 1979 281 p refs
(Contract F08635-77-C-0281; AF Proj. 2054)
(AD-A070233; AFESC/ESL-TR-79-09) Avail: NTIS HC A13/MF A01 CSCL 13/2

The purpose of this project was to investigate the precipitation of metals from plating facilities, to determine the dewatering characteristics of the resultant metal hydroxide slurries and to evaluate the solvent extraction process for metal recovery and reuse. Individual metals were found to precipitate according to the theoretical solubility calculations, however, mixed metals solutions containing Cr (III) often would form 'co-precipitants.' The co-precipitation would result in certain metals precipitating at pH levels below the range of predicted insolubility. Colloidal metal hydroxides remaining after settling could be removed by filtration using either a gravity filter or diatomaceous precoat pressure filter. Metal removal was effective (~95%) but the filtrate metal concentrations were not sufficiently low to meet effluent requirements. Sludges produced by hydroxide precipitation varied depending upon the pH of precipitation and the specific metals in the sludge. Sludge dewatering characteristics were found to be determined by the mean particle size of the flocs. Polymers improved dewatering rates by increasing the mean floc size. Freshly precipitated chromium hydroxide sludges were found to pass through filtering media because of floc break-up. Polymer conditioning was necessary to prevent sludge penetration through the filter media. Solvent extraction could be used to selectively extract individual metals from a mixed metal sludge but the process was not economical. GRA

N80-11637# Oak Ridge National Lab., Tenn.
KINETIC STUDIES OF GAS MIXTURES AND THEIR APPLICATION TO GAS LASERS AND POLLUTANT DETECTION
C. H. Chen, J. D. Judish, and M. G. Payne 1978 6 p Presented at Conf. on Appl. of Small Accelerators, Denton, Tex., 6 Nov. 1978
(Contract W-7405-eng-26)
(CONF-781113-6) Avail: NTIS HC A02/MF A01

A 2 MeV proton beam with a 10 ns pulse width was used to excite various gas mixtures. The emitted vacuum ultraviolet and ultraviolet visible photons passing through separate monochromators were detected by using single photon counting techniques. Time resolved and time integrated fluorescent spectroscopy was used to study the detailed mechanism of excitation energy transfer, Penning ionization, charge transfer, and ion-ion recombination processes. The energy precursors of various excited species in a number of gas mixtures were identified, and the quenching rates of excited atoms and ions by numerous small molecules were measured. Relative fluorescence efficiencies and energy pathways of proton excited gas mixtures were used to study the kinetics of high power gas lasers. An ultrasensitive method for the detection of certain pollutants utilizing energy or charge transfer processes in proton excited gas mixtures was developed. DOE

N80-11638# Oak Ridge National Lab., Tenn. Health and Safety Research Div.
ANALYSIS OF ORGANIC POLLUTANTS BY SYNCHRONOUS LUMINESCENCE SPECTROMETRY
T. Vo-Dinh, R. B. Gammage, and A. R. Hawthrone 1978 14 p refs Presented at the Third Intern. Symp. On Polynucl. Aromatic Hydrocarbons, Columbus, Ohio, Oct. 1978
(Contract W-7405-eng-26)
(CONF-781039-8) Avail: NTIS HC A02/MF A01

A synchronous luminescence technique was developed for the identification and quantification of polynuclear aromatic hydrocarbons in mixtures. The synchronous method was applied to fluorescence as well as phosphorescence analysis of samples of environmental interest. DOE

N80-11639# Brookhaven National Lab., Upton, N. Y. Process Sciences Div.
ENVIRONMENTAL CONTROL TECHNOLOGY FOR CARBON DIOXIDE
Meyer Steinberg, A. S. Albanese, and Vi-Duong Dang Sep. 1978 36 p refs Presented at the 71st Ann. Meeting of the

Am. Inst. of Chem. Engr., Miami, Fla., 12-16 Nov. 1978
(Contract EY-76-C-02-0016)
(BNL-24999; Conf-781110-10) Avail: NTIS HC A03/MF A01

Routes for removal, recovery, disposal, and reuse of CO2 from various control points in the global system are reviewed. The energy and mass balances for various routes are used as a criteria for evaluation. Alternative energy sources are assessed as a means of control. DOE

N80-11640# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. SOLID WASTE PROGRAMS Final Report
Aug. 1979 24 p
(Grant EPA-T-900591-03)
(PB-298586/9; EPA-600/8-79-023G) Avail: NTIS HC A02/MF A01, also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory of solid management programs and education courses is presented. The institution, program title, department, and degrees offered are identified. Approximately 74 programs are described. A.W.H.

N80-11641# Los Alamos Scientific Lab., N. Mex.
ENERGY DEVELOPMENT vs WATER QUALITY IN THE UPPER COLORADO AND UPPER MISSOURI RIVER BASINS
A. B. Bishop, S. L. Klemetson, M. F. Torpy, and M. McKee Oct. 1978 84 p refs
(Contract W-7405-eng-36)
(LA-7497-MS) Avail: NTIS HC A05/MF A01

Impacts from energy developments are discussed in terms of the various pollutants generated by energy extraction and processing activities, and the pollution transport mechanisms and pathways by which they can enter surface and groundwater. The implications for energy development of the water quality aspects of legislative requirements and regulations are discussed. Many of the potential water pollution problems associated with energy development will occur through the transport of pollutants from air pollution and solid waste disposal. The consumptive use of all water withdrawn for energy processing as a pollution control measure raises three important issues-each of which represents a potential conflict between energy developers compliance with the legislation and western water law: (1) junior rights and water transfer, (2) the beneficial use question, and (3) the reasonable use measure of certain water quality practices. DOE

N80-11642# Illinois Inst. of Tech., Chicago.
ENVIRONMENTAL EFFECTS OF HEAT AND MOISTURE RELEASE FROM ATMOSPHERIC SPRAY COOLING SYSTEMS
S. Chaturvedi and R. W. Porter 1978 11 p refs Presented at the 2d Thermophys. and Heat Transfer Conf., Palo Alto, Calif., 24 May 1978
(Contract EC-77-S-02-4531)
(CONF-780520-7) Avail: NTIS HC A02/MF A01

A thermal model for atmospheric sprays including heating and humidification of downwind elements was developed. Ambient wind and turbulent diffusivity profiles which depend on aerodynamic surface roughness and atmospheric stability were presumed to prevail throughout the domain of interest. The convective diffusion equation governing the enthalpy of the air-moisture mixture was integrated numerically continuing through and beyond the source, and the local temperature and vapor concentration were computed. Fogging is described by an equilibrium model which requires condensation of vapor in excess of saturation. Ground level dispersent concentration and height are compared with those of ground level line sources and of field and wind tunnel experiments with a finite source. DOE

N80-11643# World Meteorological Organization, Geneva (Switzerland).
METEOROLOGY AND THE HUMAN ENVIRONMENT
J. A. Izrael (USSR Hydrometeorol. Serv.), F. Kenneth Hare (Toronto Univ., Canada), and Fereidoon Hashemi 1979 54 p refs Presented at 29th Session of the WMO Executive Comm., 1977
(WMO-577; SER-13; ISBN-92-63-10517-0; Rept-13) Avail: NTIS HC A04/MF A01; WMO, Geneva SWFR 6

The texts of three lectures on man and his relationship to the environment are given. First, the problem of air pollution and other aspects of environmental pollution is dealt with, including the concept of monitoring and regulating the quality of the environment. Next, climatic variability, environmental change and human response is treated. Finally, climatology and the fight against desertification is surveyed. Author (ESA)

N80-11644# World Meteorological Organization, Geneva (Switzerland).
IMPLEMENTATION PLAN FOR THE DETERMINATION OF THE ATMOSPHERIC CONTRIBUTION OF PETROLEUM HYDROCARBONS TO THE OCEANS.
Robert A. Duce 1979 59 p refs Sponsored by UN Environ. Programme (UNEP)
(WMO-504; SER-12; ISBN-92-63-10504-9) Avail: NTIS HC A04/MF A01; WMO, Geneva SWFR 15

An implementation plan for the collection and analysis methodology to determine the atmospheric concentration and fluxes of petroleum hydrocarbons entering the open ocean from the atmosphere is developed. Included are detailed discussions of sampling site selection, atmospheric and sea-surface sample collection, analytical procedures, and a proposed timetable. It is recommended that this program be initiated on a pilot study basis in Bermuda and American Samoa. Since the measurement of petroleum hydrocarbons in the atmosphere is not routine of standardized at this time, it is recommended that this program be undertaken in a research mode, with one laboratory selected to develop and test in detail the collection and analytical procedures. Author (ESA)

N80-11645# Royal Netherlands Meteorological Inst., De Bilt.
THE USE OF A TRAJECTORY MODEL FOR STUDYING INTERREGIONAL TRANSPORT OF AIR POLLUTION
J. Reiff and C. A. Velds 1979 37 p refs
(KNMI-WR-79-6) Avail: NTIS HC A03/MF A01

The possibility of using a trajectory model, including vertical wind components, to calculate the path of air pollution traveling across the German-Netherlands border is considered. The operational trajectory model, which principally was set up for weather forecasting and which uses windfields from three layer vorticity model is described. The properties of a near-future trajectory model based on a four layer vorticity model are also discussed. The accuracy of the trajectory model is specified. Two periods of interregional transport were studied. Trajectories, calculated with the operational model, arriving at the 850 mbar level are compared with hand-analyzed trajectories at the 10 m level and with trajectories in the 80 to 200 m layer. Results show that a trajectory model including vertical wind, together with the four layer model, promises success for air pollution studies as air paths can be calculated fairly easily on a routine basis. Author (ESA)

N80-11646# Swedish Space Corp., Solna.
AIRBORNE OIL SPILL SURVEILLANCE SYSTEMS IN SWEDEN
L. Backlund 12 Mar. 1979 20 p
(FP1-9) Avail: NTIS HC A02/MF A01

Two different oil spill surveillance systems are described. These systems are presently installed in two Cessna 337 aircraft. One of the systems is based on a side looking airborne radar (SLAR) and the other on a Daedalus IR/UV-line scanner. In both systems imagery generated from the sensors is presented in real-time on a TV-monitor to the operator/co-pilot in the aircraft. The SLAR system generates black-and-white imagery whereas the IR/UV-scanner system uses false color coding for image enhancement. The IR/UV-scanner system also has capabilities of recording unprocessed data on tape, polaroid photographing of displayed images, and near real-time image transmission down to ships via a TV video to Xerox telecopier interface and a voice channel link. The technical evaluation and field testing of the two systems is summarized. Most of the tests were carried out in the Baltic Sea and included oil spill detection, cleanup surveillance, ice reconnaissance, monitoring

of fishing activities, and search and rescue operations.
Author (ESA)

N80-11647# IEA Coal Research, London (England).
HOT GAS CLEANUP
G. F. Morrison Mar. 1979 53 p refs
(ICTIS/TR-03; ISBN-92-9029-017-X) Avail: NTIS HC A04/MF A01

The current technological status of hot gas cleanup systems for cleaning gases from coal gasifiers or fluidized bed combustors prior to their use in combined cycle power generating systems is reviewed. Self contained cleanup systems which can be applied to various gasifiers or combustors are emphasized. Contaminants in the gas stream are identified as sulphur compounds, particulates, nitrogen compounds, and trace elements. Hot gas desulphurization processes are classified according to the sorbent on which they are based (iron oxide or calcium). Particulate removal is subdivided according to the separation technique. Cyclones, surface and depth filters, and electrostatic precipitators are covered.
Author (ESA)

N80-11648# TRW Environmental Services, Vienna, Va.
SUMMARY REPORT ON MOTOR VEHICLE EMISSIONS INSPECTION AND MAINTENANCE PROGRAMS FOR NON-ATTAINMENT AREAS IN LOUISIANA Final Report
John Dadiani and Thomas J. Raubacher Feb. 1979 42 p refs
(Contract EPA-68-02-2541)
(PB-294979/0; EPA-906/9-79-001) Avail: NTIS HC A03/MF A01 CSCL 13B

General information is documented on motor vehicle inspection and maintenance (I/M) with respect to the metropolitan areas of New Orleans, Baton Rouge, and Shreveport. A background discussion of events leading to the need for an I/M program is provided. A general description of I/M is provided with respect to types of programs, the benefits of I/M, and information on implementation activities. Expected hydrocarbon emission reductions are included. GRA

N80-11649# Research Triangle Inst., Research Triangle Park, N. C.
STUDY OF THE NATURE OF OZONE, OXIDES OF NITROGEN, AND NONMETHANE HYDROCARBONS IN TULSA, OKLAHOMA. VOLUME 2: DATA TABULATION
W. C. Eaton and F. E. Dimmock Apr. 1979 479 p
(Contract EPA-68-02-2808)
(PB-297801/3; EPA-540/4-79-008B) Avail: NTIS HC A21/MF A01 CSCL 13B

Tabulated ambient air quality and meteorological data resulting from surface and airborne measurements made in Tulsa, Oklahoma during July, August and September 1977 are presented. Also included are figures which illustrate the monitoring network and aircraft flight tracks followed during the airborne measurements program. GRA

N80-11650# Textile Research Inst., Princeton, N. J.
STUDIES OF DUST CAKE FORMATION AND STRUCTURE IN FABRIC FILTRATION: SECOND YEAR
Bernard Miller, George Lamb, Peter Costanza, George Harriott, and Janet Dunbar Apr. 1979 48 p refs
(Grant EPA-R-804926)
(PB-297581/1; EPA-600/7-79-108) Avail: NTIS HC A03/MF A01 CSCL 13K

The experiments to improve fabric filter efficiency and pressure drop by use of electric fields near the filter surface are described. Modified fiber geometries and fabric construction are investigated. The features of the dust cake and the fabric dust system which explain the observed changes in performance are identified. This design of improved filter fabrics and systems are discussed.
A.W.H.

N80-11651# North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
A FIELD STUDY OF THE RELATIONSHIP BETWEEN HEAVY METAL CONCENTRATIONS IN STREAM WATER AND SELECTED BENTHIC MACROINVERTEBRATE SPECIES M.S. Thesis
Richard P. Maas 1978 79 p refs
(Contract DI-14-34-0001-9035)
(PB-297284/2; W79-07570; OWRT-A-095-NC(1)) Avail: NTIS HC A05/MF A01 CSCL 13B

The correlation between heavy metal concentration in stream water and selected benthic macroinvertebrate species from stations on the Neuse River, N.C. watershed was studied to determine the utility of benthic macroinvertebrates as monitors of short and long term stream metal conditions. Cadmium, and zinc were determined in both water and test organisms by graphite furnace atomic adsorption spectrophotometry (GFAAS). The GFAAS method proved satisfactory for metal quantification in all water and test organism samples. Relatively good linear correlations between water and test organism metal concentrations were observed for most cases. GRA

N80-11652# Acurex Corp., Mountain View, Calif.
EXTENDED TESTS OF SAFFIL ALUMINUM FILTER MEDIA Final Report, Feb. 1978 - Feb. 1979
M. A. Shackleton May 1979 30 p refs
(Contract EPA-68-02-2611)
(PB-297567/0; EPA-600/7-79-112) Avail: NTIS HC A03/MF A01 CSCL 13K

Dust feeding of Saffil alumina ceramic filters was tested at 800 C and 10 atm pressure, using reentrained fly ash. Pressure drop and collection efficiency were determined as functions of time and filter face velocity. Off line cleaning by reverse pulse was effective in maintaining low pressure drop after a cleaning cycle. Collection efficiency was high and was also substantially independent of face velocity over the range tested. Outlet concentration was less than the most stringent requirements proposed for turbine applications and showed a trend toward lower values at higher filtration velocity. Mechanical durability was indicated in that none of the test filters appeared to have been damaged by the 200-hour tests with cleaning at 10 minute intervals. GRA

N80-11653# Massachusetts Inst. of Tech., Cambridge. Sea Grant Coll. Program.
ALL THE WATER ON EARTH IS ALL THE WATER THERE IS
Dean A. Horn Apr. 1979 13 p refs
(PB-298340/1; MITSG-79/5; NOAA-79061B08) Avail: NTIS HC A02/MF A01 CSCL 13B

The ocean's capacities, and how these limits change with time are described. The education of young people, in order to create a conscious awareness of man's dependence on water, is proposed. GRA

N80-11654# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
TRACE METALS AND MARINE PRODUCTION PROCESSES
Richard A. Feely and Herbert Curl, Jr. Jan. 1979 29 p refs Proc. of a Workshop held at The Pacific Marine Environmental Lab., Seattle, 28 Feb. - 2 Mar. 1978
(PB-298333/6; CONTRIB-385; NOAA-79062601) Avail: NTIS HC A03/MF A01 CSCL 13B

As part of a program studying the long-range effects of pollution the Pacific Marine Environmental Laboratory, one of the Environmental Research Laboratories of NOAA, conducted a workshop to prepare recommendations for research on the effects of trace metals on estuarine and coastal ecosystems. GRA

N80-11655# GCA Corp., Bedford, Mass. GCA Technology Div.
AIR QUALITY MAINTENANCE ANALYSIS FOR NEW JERSEY-NEW YORK AND MID-HUDSON AQMA Final Report
Kenneth W. Wiltsee, Jr., William L. Frech, and David B. Ramsay Jun. 1979 408 p refs
(Contract EPA-68-02-2866)
(PB-297988/8; GCA-TR-79-19-G; EPA-902/4-78-006) Avail: NTIS HC A18/MF A01 CSCL 13B

The year 1975 was used as the base for the air quality maintenance analysis and projections were made to 1980, 1985, and 2000. An emissions inventory created under a previous contract was reviewed and updated using best available data. Improvements were made in the point source inventory, county level area source inventories, and subcounty allocation procedures.

A version of the AQDM model was validated and then used to predict annual regional air quality levels for each year. The results indicate that annual primary SO2 and TSP standards could be exceeded in the South Bronx by 2000. TSP levels throughout much of northeastern New Jersey and New York City exceed the secondary TSP annual guidelines. GRA

N80-11656# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.

TECHNICAL ASSESSMENT OF THERMAL DeNOx PROCESS Final Report, Nov. 1977 - Dec. 1978

C. Castaldini, K. G. Salvesen, and H. B. Mason May 1979 138 p

(Contract EPA-68-02-2611)

(PB-297947/4; EPA-600/7-79-117) Avail: NTIS HC A07/MF A01 CSCL 13B

The thermal deNOx process applied to coal fired utility boilers is assessed. It is concluded that the process is a promising technique for controlling NOx emissions. However, flue gas temperature fluctuations may limit NOx reductions to approximately 50%. In addition, operational and environmental impacts of NH3 emissions and ammonium bisulfate formation could further limit the performance of the process and effect is applicability. Costs depend primarily on boiler size, initial NOx concentration, and level of control required. The impact of widespread process implementation on the ammonia market, feedstock supplies, and their costs are considered and found to be small. GRA

N80-11657# Air Pollution Technology, Inc., San Diego, Calif.

MOBILE BED FLUX FORCE/CONDENSATION SCRUBBERS Final Report, Nov. 1975 - Dec. 1978

S. C. Yung, R. Chmielewski, and S. Calvert Feb. 1979 262 p refs

(Contract EPA-68-02-2124)

(PB-297198/4; EPA-600/7-79-071) Avail: NTIS HC A12/MF A01 CSCL 13B

Fine particle collection in mobile bed scrubbers was determined experimentally. Particle collection efficiency increased greatly as the gas phase pressure drop increased. Compared to packed bed and sieve plate scrubbers, the mobile bed scrubber had better efficiency when the pressure drop was above 20 cm W.C. Limestone in the scrubber liquid had no effect on particle collection. When the mobile bed scrubber was used as a flux force/condensation (FF/C) scrubber, it had better performance characteristics than sieve plate and spray scrubbers with condensation. However, its capability was inferior to a FF/C system consisting of a condenser and venturi scrubber. Correlations to predict particle collection and pressure drop were developed. GRA

N80-11658# California Univ., Davis. Dept. of Vegetable Crops.

INTERACTION OF LOW LEVELS OF OZONE AND RELATIVE HUMIDITY ON LEAFY VEGETABLES Final Report, Jun. 1977 - Oct. 1978

J. P. Bennett Mar. 1979 30 p refs

(Contract ARB-AG-194-30)

(PB-297062/2; ARB-R-AG-194-30-79-98) Avail: NTIS HC A03/MF A01 CSCL 13B

The effects of varying levels of ozone and humidity on the yields of leaf lettuce and spinach were studied. Generalizations about yield losses in humid vs. dry environments were not possible because spinach yield losses due to ozone were greater at 50% than at 80% relative humidity while lettuce yield losses followed the opposite pattern. Lettuce plants were also significantly smaller and more tender, rendering them unmarketable regardless of the weight loss. This occurred at a concentration below the California one hour ozone standard of 0.10 ppm and suggests that the standard does not adequately protect this crop. GRA

N80-11659# Stop-Los Co., West Orange, N. J.

REDUCTION OF AIR EMISSIONS FROM GASOLINE STORAGE TANKS Final Report, Jan. 1978 - Jan. 1979

Arnold Gunther May 1979 39 p

(Contract EPA-68-02-2679)

(PB-297976/3; EPA-600/2-79-108) Avail: NTIS HC A03/MF A01 CSCL 13B

The technical and economic feasibility of using flexible plastic membranes to control emissions from gasoline storage tanks was investigated. A demonstration pilot unit was built and operated. The emission rates were determined as well as the life expectancy of the membranes. The results indicate that emission control of 99-plus percent, compared to uncontrolled tanks, can be achieved readily, and that the life expectancy of the membranes is in the order of 20 years of continuous service. The estimated installed cost of these devices for commercial application is very competitive with conventionally used floating roofs. GRA

N80-11660# Institute of Industry of Cement Building Materials (Poland).

TEST OF FABRIC FILTRATION MATERIALS Final Report, Jun. 1973 - Dec. 1978

Jan R. Koscianowski, Lidia Koscianowska, and Maria Szablewicz Mar. 1979 268 p refs

(PB-297500/1; EPA-600/7-79-087) Avail: NTIS HC A12/MF A01 CSCL 13K

The report describes pilot scale and laboratory tests of U.S. and Polish woven baghouse fabrics. Cotton, polyester, aramid, and glass fabrics were tested using cement, flyash, coal, and talc dusts at loadings of about 10 g/cu m, filtration velocities of 60 and 80 cu m/sq m, and ambient temperature and humidity. General conclusions reached were: (1) air permeability is a poor predictor of fabric performance, (2) fabric construction parameters do not correlate well with the resistance coefficient for fabrics Kl, (3) a critical value of pressure drop exists above which fissures are formed in the dust cake, (4) there is a maximum in the efficiency versus air-to-cloth-ratio curve which is related to fissure formation, and (5) cleaning properties of the fabric depend primarily on its chemical composition, the dust being filtered, and the superficial structure of the dust cake and fabric (they do not depend on air-to-cloth ratio). GRA

N80-11661# Fish and Wildlife Service, Fort Collins, Colo. Western Energy and Land Use Team.

PHYSICAL REGIONALIZATION OF COASTAL ECOSYSTEMS OF THE UNITED STATES AND ITS TERRITORIES

Terry T. Terrell Mar. 1979 39 p refs Sponsored in part by EPA

(PB-297143/0; FWS/OBS-78-80) Avail: NTIS HC A03/MF A01 CSCL 13B

A hierarchical regional classification scheme for partitioning coastal ecosystems of the United States and its territories based on the physical (mainly hydrological and geological) characteristics of those areas was formulated. Physical rather than biotic criteria were utilized so as to define whole ecosystems, rather than to define the distribution of a few species. The classification provides a data collection structure and delineates geographic zones about which predictions on the structure and functioning of ecosystems within these zones may be made at various levels of resolution. Boundaries as defined by the National Wetlands Inventory were used extensively for landward and seaward limits. GRA

N80-11662# North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.

SMOG CHAMBER VALIDATION USING LAGRANGIAN ATMOSPHERIC DATA Interim Report

Charles Eugene Feigley, Harvey E. Jefferies, and Myra A. Carpenter May 1979 272 p refs

(Grant EPA-800916)

(PB-297480/6; EPA-600/3-79-050) Avail: NTIS HC A12/MF A01 CSCL 04A

A method was developed for validating outdoor smog chamber experiments. When chamber experiments were performed in a manner that simulated relevant meteorological processes and precursor concentrations, the validation method showed that photochemical smog reactions observed in the smog chamber generally agreed with data from the Los Angeles Reactive Pollutant Programs. GRA

N80-11663# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.

USPHS/NIOSH MEMBRANE FILTER METHOD FOR EVALUATING AIRBORNE ASBESTOS FIBERS

Stephen G. Bayer, Ralph D. Sumwalde, and Kenneth A. Busch
Feb. 1979 93 p refs
(PB-297731/2; DHEW/PUB/NIOSH-79/127) Avail: NTIS HC A05/MF A01 CSCL 07D

The equipment and procedures for collecting, mounting, sizing, and counting asbestos fibers on cellulose ester membrane filters are described. Procedures for treating random and systematic errors are presented, including statistical procedures for determining compliance with asbestos exposure standards. Five phase contrast microscopes for asbestos counting are evaluated. GRA

NBO-11664# National Field Research Center, Inc., Iowa City, Iowa.

NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. PESTICIDES AND TOXICOLOGY PROGRAMS Final Report

Aug. 1979 94 p
(Grant EPA-T-900591-03)
(PB-298582/8; EPA-600/8-79-023C) Avail: NTIS
HC A05/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory of post secondary pesticides and toxicology programs in the U.S. is presented. One hundred and thirty-five academic program titles are listed along with names and addresses of institutions, degrees offered, and contact persons. K.L.

NBO-11665# National Field Research Center, Inc., Iowa City, Iowa.

NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3: POTABLE WATER PROGRAMS Final Report

Aug. 1979 41 p
(Grant EPA-T-900591-03)
(PB-298583/6; EPA-600/8-79-023D) Avail: NTIS
HC A03/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory of potable water education/training programs is presented. Categories identified are hydrology, aquatic biology, hydrogeology, water works technology, marine environmental sciences, and coastal oceanography. Forty one programs are identified. A.W.H.

NBO-11666# National Field Research Center, Inc., Iowa City, Iowa.

NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. WATER/WASTEWATER PROGRAMS Final Report

Aug. 1979 119 p
(Grant EPA-T-900591-03)
(PB-298588/5; EPA-600/8-79-023I) Avail: NTIS
HC A06/MF A01, also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

The volume of post-secondary education/training entries presents those programs which are classified as intersecting both environmental areas of potable water and wastewater. Programs categorized as applicable to either potable water or to waste-water, solely, will be found in those individual volumes of this report. This volume includes 183 water/wastewater programs which represent 46 states and one territory. In order for the program to be included in this directory, the catalog description must list at least three water and/or waste-water courses necessary for program completion. GRA

NBO-11667# National Field Research Center, Inc., Iowa City, Iowa.

NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. COMPOSITE: ENVIRONMENTAL ENGINEERING/TECHNOLOGY Final Report

Aug. 1979 116 p
(Grant EPA-T-900591-03)
(PB-298589/3; EPA-600/8-79-023J) Avail: NTIS
HC A06/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

Information on post-secondary environmental education programs in the United States is presented in this twelve volume directory. Programs are representative of all levels, from academic certification through doctoral degrees. The environmental pollution control areas of air, noise, pesticides, potable water, radiation, solid waste, wastewater and energy were surveyed. In addition, some programs which were not readily categorized into media-specific areas (i.e., radiation, air, etc.) or which represented multiple media areas in curricula content, were presented under the title of composite. R.E.S.

NBO-11668# National Field Research Center, Inc., Iowa City, Iowa.

NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. COMPOSITE: ENVIRONMENTAL SCIENCE/HEALTH Final Report

Aug. 1979 131 p
(Grant EPA-T-900591-03)
(PB-298590/1; EPA-600/8-79-023K) Avail: NTIS
HC A07/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory of post-secondary environmental education programs in the U. S. is presented. Names and addresses of institutions, academic program titles, contact persons, and degrees offered are listed. Areas of program concentration include marine and environmental sciences, solar energy, potable water supply, wastewater, land use, ecology, environmental biology, industrial hygiene, toxicology, radiation health, environmental management, environmental earth science, environmental and regional planning, environmental monitoring, and pollution prevention and control. K.L.

NBO-11669# National Field Research Center, Inc., Iowa City, Iowa.

NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. COMPOSITE: ENVIRONMENTAL STUDIES Final Report

Aug. 1979 202 p
(Grant EPA-T-900591-03)
(PB-298591/9; EPA-600/8-79-023L) Avail: NTIS
HC A10/MF A01; also available in set of 18 reports PC-E99, PB-298579-SET CSCL 05I

A directory of general environmental education programs is presented. Areas identified are environmental studies, environmental education, marine sciences, environmental management, and general environmental programs. The directory includes 336 programs. A.W.H.

NBO-11670# National Field Research Center, Inc., Iowa City, Iowa.

NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. AIR PROGRAMS Final Report

Aug. 1979 39 p
(Grant EPA-T-900591-03)
(PB-298580/2; EPA-600/8-79-023A) Avail: NTIS
HC A03/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

Information on post-secondary environmental education programs in the United States is provided. Structured around information requests mailed to post-secondary education institutions, the directory provides the name and address of each institution listed, a contact person at each institution, the academic program title, and the degree offered at the institution (2-year, 4-year, etc.) Twelve such directories of post-secondary programs include: one each for air, noise, pesticides and toxicology, potable water, wastewater, radiation, solid waste, and energy; one for combined water/wastewater programs; and a composite volume on each of the three areas of environmental engineering/technology, environmental science/health, and environmental studies. GRA

NBO-11671# National Field Research Center, Inc., Iowa City, Iowa.

NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. NOISE PROGRAMS Final Report

Aug. 1979 29 p
(Grant EPA-T-900591-03)
(PB-298581/0; EPA-600/8-79-023B) Avail: NTIS
HC A03/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory of identified post secondary education and/or training programs pertinent to the control of noise pollution is

presented. Categories identified are acoustics, noise and its control, measurement of sound/instrumentation, and hearing conservation. Sixteen noise programs are identified. A.W.H.

N80-11672# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. WASTEWATER PROGRAMS Final Report
Aug. 1979 34 p
(Grant EPA-T-900591-03)
(PB-298584/4; EPA-600/8-79-023E) Avail: NTIS HC A03/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory which identifies and describes waste water pollution control education/training programs is presented. Education areas include water resources, waste water pollution, plant operations, environmental health, waste water treatment and disposal, plant design, and water chemistry. Twenty eight education/training programs are identified. A.W.H.

N80-11673# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. RADIATION PROGRAMS Final Report
Aug. 1979 40 p
(Grant EPA-T-900591-03)
(PB-298585/1; EPA-600/8-79-023F) Avail: NTIS HC A03/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory which identifies and describes radiation education/training programs is presented. Categories identified are health physics, radiation health and safety, radiological health, nuclear or radiological waste management, and radiological technician training. Thirty nine program entries are identified. A.W.H.

N80-11674# National Technical Information Service, Springfield, Va.
AIRPORT NOISE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Guy E. Habercom, Jr. Sep. 1979 271 p Supersedes NTIS/PS-78/0807, NTIS/PS-77/0704, NTIS/PS-76/0625 and NTIS/PS-75/530
(NTIS/PS-79/0878/3; NTIS/PS-78/0807; NTIS/PS-77/0704; NTIS/PS-76/0625; NTIS/PS-75/530) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Aircraft created noise, noise intensity, noise exposure, and physiological effects, all in airport environments, are investigated in these research reports. This updated bibliography contains 265 abstracts, 19 of which are new entries to the previous edition. GRA

N80-11675# National Technical Information Service, Springfield, Va.
CHEMICAL ANALYSIS OF AEROSOLS AND AIRBORNE PARTICULATES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Jul. 1979
Diane M. Cavagnaro Aug. 1979 147 p Supersedes NTIS/PS-78/0756, NTIS/PS-77/0717, NTIS/PS-76/0617, NTIS/PS-75/527 and COM-74-11018
(NTIS/PS-79/0791/8; NTIS/PS-78/0756; NTIS/PS-77/0717; NTIS/PS-76/0617; NTIS/PS-75/527; COM-74-11018) Avail: NTIS HC $28.00/MF $28.00 CSCL 07D

Reports are cited covering the chemical analysis and composition of aerosols and airborne particulate matter. Articles on particle sampling techniques and size analysis are excluded. Some of the techniques that are described include chromatography, activation analysis, and spectroscopic analysis. This bibliography contains 141 abstracts, 40 of which are new entries to the previous edition. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-11676*# National Aeronautics and Space Administration. *Ames Research Center, Moffett Field, Calif.*
EFFICIENCY OF AEROSOL COLLECTION ON WIRES EXPOSED IN THE STRATOSPHERE
Homer Y. Lem (LFE Environmental Analysis Labs. Div.) and Neil H. Farlow Oct. 1979 29 p refs
(NASA-TM-81147; A-7958) Avail: NTIS HC A03/MF A01 CSCL 04A

The theory of inertial impaction is briefly presented. Stratospheric aerosol research experiments were performed duplicating Wong et al. experiments. The use of the curve of inertial parameters vs particle collection efficiency, derived from Wong et al., was found to be justified. The results show that stratospheric aerosol particles of all sizes are collectible by wire impaction technique. Curves and tables are presented and used to correct particle counts for collection efficiencies less than 100%. R.E.S.

N80-11677*# Ohio State Univ. Research Foundation, Columbus.
AN INVESTIGATION OF A MATHEMATICAL MODEL FOR ATMOSPHERIC ABSORPTION SPECTRA Interim Report
Edward R. Niple Jul. 1979 88 p refs
(Grant NsG-7479; RF Proj. 761420/711626)
(NASA-CR-162430) Avail: NTIS HC A05/MF A01 CSCL 04A

A computer program that calculates absorption spectra for slant paths through the atmosphere is described. The program uses an efficient convolution technique (Romberg integration) to simulate instrument resolution effects. A brief information analysis is performed on a set of calculated spectra to illustrate how such techniques may be used to explore the quality of the information in a spectrum. Author

N80-11678# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
GLOBAL LIGHTNING DISTRIBUTION AT DAWN AND DUSK FOR AUGUST-DECEMBER 1977 AS OBSERVED BY THE DMSD LIGHTING DETECTOR Interim Report
Bruce C. Edgar 15 Jun. 1979 35 p refs
(Contract F04701-78-C-0079)
(AD-A071896; TR-0079-4639-1; SAMSO-TR-79-43) Avail: NTIS HC A03/MF A01 CSCL 04/1

The lightning detector aboard a DMSP satellite in a dawn-dusk polar orbit sampled lightning activity worldwide during August-December 1977. At dawn the distribution of events is somewhat evenly spread over both hemispheres with a slight bias towards land areas in the summer hemisphere. There is significant activity over the oceans in both hemispheres at dawn, presumably due to radiative cooling of the atmosphere. However, at dusk lightning occurs primarily over the warmer land areas in the summer hemisphere with very few events in the winter hemisphere. Also there is a marked increase of lightning events about the tropical convergence zone. These distribution plots give for the first time a global snapshot of lightning activity which could lead to a better understanding of the global atmospheric noise distribution. GRA

N80-11679# *Pennsylvania State Univ., University Park.* Ionosphere Research Lab.
MEASUREMENTS OF IMPORTANT MINOR CONSTITUENTS IN THE MIDDLE ATMOSPHERE Final Report, Apr. 1976 - Apr. 1979
John J. Olivero 18 Jun. 1979 10 p refs
(Grants DAAG29-76-G-0219; DAAG29-78-G-0083)
(AD-A071845; PSU-IRL-FR-79/2; ARO-13877.3-GSX) Avail: NTIS HC A02/MF A01 CSCL 04/1

This final report summarizes two major projects. The first is the design and development of a ground based microwave radiometer for the measurement of water vapor in the middle atmosphere. The second is the detailed study of the possible existence of small ice particles in the mesosphere under normal

conditions as has been hypothesized by D-region electrical structure measurements. GRA

N80-11680# Utah State Univ., Logan.
ELIMINATION OF THE EFFECT OF SURFACE MICROTOPOGRAPHY IN AN IMPROVED SOIL SKIN MOISTURE DETERMINATOR
Inge Dirmhirn White Sands Missile Range, N. Mex. Atmospheric Sciences Lab. Jun. 1979 20 p refs
(Contract DAEA18-76-C-0051; DA Proj. 1L1-62111-AH-71)
(AD-A072614; ERADCOM/ASL-CR-79-0051-1) Avail: NTIS HC A02/MF A01 CSCL 08/13

This report discusses the development of an instrument, the soil surface moisture determinator (SSMD), that provides soil surface moisture independent of the microstructure of the surface. Such an instrument was needed because the reflection characteristics of soils and sands depend on the moisture and microstructure of the surface layer; and under natural conditions; the many surfaces of different slope and exposure that account for the soil surface layer interfere with a simple relation between soil moisture and reflection. Tests performed with the SSMD show that the instrument can provide knowledge of the moisture content of the soils with one simple measurement. The results of the measurements do not provide information on the moisture condition within the soil, but the knowledge of the moisture of the surface layer can readily be correlated with all remotely detected data. GRA

N80-11681# Nova Univ., Dania, Fla. Ocean Science Center.
IMPROVED DETERMINATIONS OF THE EARTH'S GRAVITY FIELD
Georges Blaha 31 Jan. 1979 163 p refs
(Contract F19628-78-C-0013; AF Proj. 2309)
(AD-A070186; AFGL-TR-79-0058) Avail: NTIS HC A08/MF A01 CSCL 08/5

Partial contents: An Accurate Non-iterative Algorithm for Computing the Length of a position Vector to a Subsatellite Point; Feasibility of the Short Arc Adjustment Model in SEASAT-a Altimetry Reductions Mathematical Outline of the Short Arc Orbital Investigation, and Realistic GEOS-3 and SEASAT-A analysis; Accuracy Improvement in Adjusting Gravity Anomalies; Geopotential Model Containing Spherical Harmonics and Point Masses; Refinement of the Gravity Anomaly Model -- Gravity Anomaly Mathematical Model, Gravity Mathematical Model, Comparison of the Gravity and the Gravity Anomaly Models, Equivalence of the Coefficients, and Equivalence of the Constant Terms. GRA

N80-11682# Systems Science and Software, La Jolla, Calif.
SYNTHESIS OF REGIONAL GROUND MOTION FROM WESTERN US EARTHQUAKES Final Report, Nov. 1977 - Dec. 1978
W. L. Rodi, T. C. Bache, H. J. Swanger, T. G. Barker, and J. T. Cherry Hanscom AFB, Mass. Air Force Geophysics Lab. 29 Mar. 1979 206 p
(Contract F19628-77-C-0004; AF Proj. 2309)
(AD-A069727; SSS-R-79-3988; AFGL-TR-79-0080) Avail: NTIS HC A10/MF A01 CSCL 08/11

Synthetic displacement, velocity and acceleration seismograms and the resulting response spectra are computed and analyzed for earthquake ground motions in the western United States. A source model for the 1975 Pocatello Valley earthquake is used with plane layered earth models to estimate the ground motions at Minuteman Wing V which is at a range of about 700 km. The 1975 Yellowstone earthquake was a similar event at the same range from Wing V. However, the ground motions are estimated to be an order to magnitude smaller due to three effects: the two earthquakes were the same size at long periods but the Yellowstone event appears to be a factor of 2 to 4 smaller at short periods; the sources are oriented such that radiation pattern differences between the two events are nearly maximum; the Yellowstone caldera and, perhaps, other highly attenuating structures to the south cause the Wing V ground motions from the Yellowstone event to be much smaller than otherwise expected. GRA

N80-11683# Ford Aerospace and Communications Corp., Newport Beach, Calif. Aeronutronic Div.
METHOD OF CALCULATING H2O TRANSMISSION BETWEEN 333 AND 633 cm-1 Final Report, 4 Oct. 1976 - 30 Sep. 1978
Darrell E. Burch and David A. Gryvnak Apr. 1979 52 p refs
(Contract F19628-76-C-0302; AF Proj. 7670)
(AD-A072850; AFGL-TR-79-0054; U6503) Avail: NTIS HC A04/MF A01 CSCL 04/1

Spectral absorption data are presented for H2O between 1/333 cm and 1/633 cm. An empirical continuum has been determined to account for all of the absorption not attributed to absorption lines centered within approximately 1/30 cm of any wavenumber of observation. The empirical continuum, which consists of one part for self broadening of the H2O lines and one part for N2 broadening, has been determined experimentally for three temperatures: 296K, 338K and 430K. Other values based on extrapolation have been determined for lower temperatures representative of the atmosphere. A line-by-line calculation scheme involving the empirical continuum and the AFGL line parameters has been used to calculate spectra for several samples investigated in the laboratory. The calculated spectra agree quite well with the laboratory spectra. GRA

N80-11684# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
LOW LATITUDE ATMOSPHERIC X-RAYS OBSERVED BY HEAO-1 Interim Report
Janet G. Luhmann, Hugo R. Rugge, J. Bernard Blake, and Lee A. Christopher 16 Jul. 1979 22 p refs
(Contract F04701-78-C-0079)
(AD-A072722; TR-0079(4960-05)-4; SAMSO-TR-79-69) Avail: NTIS HC A02/MF A01 CSCL 04/1

The low energy (0.15-3keV) proportional counter detectors of the A-2 experiment on the X-ray astronomy satellite HEAO-1 have detected night-time atmospheric emissions at the limb of the earth. Three observations of this phenomenon occurred during the first two months of operation. On two occasions, fluxes greater than the diffuse galactic background were detected when the detectors scanned the limb in the vicinity of the magnetic conjugate point of the South Atlantic Anomaly. Enhanced emissions were also observed on a single scan of the atmosphere over northern Africa. The X-rays are presumed to result from bremsstrahlung generated by precipitating electrons. In the case of the emissions related to the Anomaly conjugate point, it is suggested that the electrons were secondaries backscattered from the atmosphere above the Anomaly during the intensified precipitation of radiation belt particles that occurs throughout a magnetic storm recovery period. These initial observations demonstrate that the earth's atmosphere can be a significant X-ray source at low latitudes as well as in the auroral zones, and hence that it may be practical to remotely monitor the global morphology of particle precipitation by satellite observations of terrestrial X-rays. GRA

N80-11685# Air Force Geophysics Lab., Hanscom AFB, Mass.
REPORT ON PERU SCINTILLATION TESTS, MARCH 1978 Air Force Surveys in Geophysics
H. E. Whitney 22 Jan. 1979 102 p
(AF Proj. 4643)
(AD-A072994; AFGL-TR-79-0030; AFGL-AFSG-407) Avail: NTIS HC A06/MF A01 CSCL 08/14

This report summarizes the occurrence of ionospheric scintillation observed during March 1978 scintillation tests conducted in Peru. The data are reduced and presented as was done in AFGL-TR-77-0282, 'Report on Peru Scintillation Tests - October 1976 and March 1977.' GRA

N80-11686# Air Force Geophysics Lab., Hanscom AFB, Mass.
CORRELATION STUDIES OF PROTONOSPHERIC ELECTRON CONTENT OVER THE US CONTINENT Environmental Research Papers
A. Shuval, J. A. Klobuchar, and H. Soicher 6 Mar. 1979 27 p refs
(AF Proj. 4643)
(AD-A073080; AFGL-TR-79-0064; AFGL-ERP-658) Avail: NTIS HC A03/MF A01 CSCL 08/14

Measurements of the electron content of the earth's protonosphere, N sub p, defined here as the region above the height where Faraday rotation measurements of VHF signals

are significant, have been compared from pairs of stations in North America. Results of studies of N sub p and of the variabilities from the monthly mean values at station pairs show a lower correlation than expected. Correlation coefficients of total electron content data taken at the same station pairs by the group-delay technique and by the Faraday rotation technique are significantly higher than those from N sub p data. The random component necessary to explain the lower than expected correlation of N sub p values is larger than the estimated data accuracy from the stations. From the available data we are unable to conclude whether or not the lower than expected correlation coefficients represent a real random component in the protonosphere having horizontal scale sizes less than 400 km. GRA

N80-11687# Alaska Univ., Fairbanks. Geophysical Inst.
NON-NEUTRAL FIELD-ALIGNED CURRENT SHEET AND AURORAL ELECTRIC FIELD Final Report, 15 May - 31 Dec. 1978
R. K. Albano, L. C. Lee, and J. R. Kan Feb. 1979 21 p refs
(Contract F19628-78-C-0128; AF Proj. 2311)
(AD-A072852; AFGL-TR-79-0066) Avail: NTIS HC A02/MF A01 CSCL 04/1

Equilibrium configurations of the non-neutral field-aligned electron current sheet in a Maxwellian plasma are obtained from solutions of the time-independent Vlasov-Maxwell equations. This is the first field-aligned non-neutral current sheet model in a hot plasma in which the electrons are allowed to be nonadiabatic. The current in this model has a perpendicular as well as a parallel component to the external magnetic field. The electric field of the current sheet is pointing normally toward the midplane of the sheet. This zeroth-order perpendicular electric field is identified as the primary electric field which gives rise to a few keV potential drop along auroral field lines. GRA

N80-11688# Stanford Univ., Calif. Guidance and Control Techniques.
STUDY TO DEVELOPMENT GRADIOMETER TECHNIQUES
D. B. DeBra, J. V. Breakwell, and M. Kurosaki Jan. 1979 46 p refs
(Contract F19628-78-C-0038; AF Proj. 3201)
(AD-A072821; AFGL-TR-79-0063; SCIENTIFIC-1) Avail: NTIS HC A03/MF A01 CSCL 08/5

This report is concerned with the problem of real-time filtering of gravity-gradiometer readings onboard a uniformly horizontally moving vehicle to produce estimates of the gravity deflection and gravity anomaly at the vehicle's position. GRA

N80-11689# Utah State Univ., Logan. Electro-Dynamics Lab.
STUDIES OF ATMOSPHERIC INFRARED EMISSIONS Final Report, 1 Jan. 1973 - 31 Dec. 1977
Doran J. Baker 1 Jan. 1978 87 p refs
(Contract F19628-73-C-0048)
(AD-A072831; AFGL-TR-78-0251) Avail: NTIS HC A05/MF A01 CSCL 04/1

This contract between the Air Force Geophysics Laboratory and Utah State University provided for the investigation into the nature of the disturbed and undisturbed atmosphere with particular emphasis placed upon the spectral, spatial, and temporal behavior of atmospheric emission and the controlling stimuli that initiate such emission. A major thrust was concentrated on the development of new instrumentation and measuring techniques and their use in the measurement program, particularly in atmospheric disturbances. GRA

N80-11690# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
COORDINATED DATA ANALYSIS OF ONR-118 DATA Final Report
R. G. Johnson, R. D. Sharp, and E. G. Shelley Aug. 1978 33 p refs
(Contract N00014-77-C-0600)
(AD-A073113; LMSC/D626959) Avail: NTIS HC A03/MF A01 CSCL 04/1

This is the final report of a program to study the physical causes of ionospheric scintillation and disturbance phenomena by performing coordinated observations of the energetic particle inputs to the disturbance region and the resulting disturbance phenomena as observed in the ionosphere. GRA

N80-11691# Environmental Research and Technology, Inc., Concord, Mass.
ANALYSIS OF TROPOSPHERIC EFFECTS AT LOW ELEVATION ANGLES Final Report, 1 Jan. 1977 - 31 May 1978
Robert K. Crane Nov. 1978 69 p refs
(Contract F19628-77-C-0074; AF Proj. 4600)
(AD-A073089; RADC-TR-78-252) Avail: NTIS HC A04/MF A01 CSCL 04/1

Precision low elevation angle radar observations of orbiting spheres were used to evaluate the utility of surface based refraction techniques. Elevation angle error measurements were obtained from differences between the precision radar measurements and the true or absolute position of the orbiting sphere obtained from a multiple pass orbit determination using data from the same radar system. The results of the refraction effects study show that the average observed elevation angle error caused by refraction is identical with the average calculated elevation angle error obtained from ray tracings using radiosonde data to within the measurement accuracy of the radar system. The results also reveal a relatively large uncorrectable component of the elevation angle error caused by small scale refractive index gradients. This uncorrectable component is of the order of 30 millidegrees (mdeg) at a true elevation angle of 1 degree and 4 mdeg at 10 degrees. GRA

N80-11692# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
A CASE STUDY OF S3-2 OBSERVATIONS IN THE LATE EVENING AURORAL OVAL
W. J. Burke, D. A. Hardy, F. J. Rich, M. C. Kelley (Cornell Univ., Ithaca, N.Y.), M. Smiddy, B. Shuman, R. C. Sagalyn, R. P. Vancour, P. J. L. Wildman, and S. T. Lai (Logicon, Inc., Lexington, Mass.) 8 Jan. 1979 42 p refs
(AF Proj. 2311)
(AD-A072996; AFGL-TR-79-0011; AFGL-ERP-651) Avail: NTIS HC A03/MF A01 CSCL 04/1

Instrumentation aboard the polar-orbiting Air Force satellite S3-2, as well as the methods by which the measurements are reduced to geophysically significant quantities, are described in great detail. The quality of the high-time resolution data is illustrated using measurements of an auroral zone overpass in the late evening sector when simultaneous DMSP imagery was also available. The validity of the data reduction processes is corroborated by a detailed comparison of simultaneous measurements of the entire complement of scientific experiments on the satellite. GRA

N80-11693# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
STUDY OF THE EQUATORWARD EDGE OF THE AURORAL OVAL FROM SATELLITE OBSERVATIONS Scientific Interim Report Environmental Research Papers
B. S. Dandekar 9 Jan. 1979 44 p refs
(AF Proj. 4643)
(AD-A072997; AFGL-TR-79-0010; AFGL-ERP-650) Avail: NTIS HC A03/MF A01 CSCL 04/1

The auroral ovals in the Northern and Southern Hemispheres observed by the optical instruments aboard the DMSP satellites are studied on a statistical basis in terms of the temporal, spatial, and magnetic activity dependence of the equatorward edge of the diffuse (continuous) aurora. In the nightside (18-08 CGT), the equatorward edges of the auroral ovals are located predominantly in the latitude range 61 deg - 69 deg CGL. They show strong dependence on the levels of magnetic activity. Of the indices Kp, AE, Dst, and Q, the Q index is correlated best with the position of the equatorward edge of the diffuse aurora. Assuming that the auroral oval is approximately circular in a CG coordinate system, the dependence of the radius of the auroral oval on magnetic activity is determined. The radius and the center of the auroral circle changes with variation in magnetic activity. The ovals of the Northern and Southern Hemispheres consistently show an asymmetry. On the nightside, the oval in the Southern Hemisphere is located about 1 deg closer to the equator than the oval in the Northern Hemisphere. GRA

N80-11694# Air Force Geophysics Lab., Hanscom AFB, Mass.
PHASE SPACE COORDINATES OF LONG LIFETIME TRAPPED RADIATION FROM STOERMER MAPPING
Charles W. Dubs 18 Jan. 1979 28 p refs
(AF Proj. 2311)
(AD-A072995; AFGL-TR-79-0029; AFGL-ERP-655) Avail: NTIS HC A03/MF A01 CSCL 04/1

The concept of an 'essentially closed' manifold and several theorems on a plane mapping are introduced and applied to a 'Stoermer mapping' for a particle trapped in a dipole magnetic field. The trapped region is found to be divisible into many subregions in any one of which a particle forever remains confined. Alternatives are given to Dragt and Finn's interpretation that homoclinic points exist. A method is given of determining if they do exist. Numerical examples are given of regions of phase space where protons should have a long lifetime. GRA

N80-11695# Air Force Geophysics Lab., Hanscom AFB, Mass.
A DYNAMICAL MODEL FOR THE ONSET OF MAGNETOSPHERIC SUBSTORMS
P. L. Rothwell and G. K. Yates 13 Dec. 1978 44 p refs
(AF Proj. 7601)
(AD-A072987; AFGL-TR-78-0306; AFGL-ERP-647) Avail: NTIS HC A03/MF A01 CSCL 04/1

A model for the onset of magnetospheric substorms is developed based on the observations of Pytte et al (1976). North-south single-particle motion across the plasma sheet becomes instrumental in generating magnetic instabilities when the plasma sheet is sufficiently compressed. The number density times the square of the plasma sheet thickness is found to be the critical parameter (nl squared less than or equal to 8.1 x 10 to the 15th power protons/cm). A merging theory is developed based on these magnetic instabilities. The nightside merging rate is controlled by the value of the magnetic field in the tail lobes which, in turn, is dependent on the dayside merging rate. Merging and collisional damping of the J x B force contribute to the heating of the plasma sheet. The 10-15 min interval between onsets is interpreted in terms of a weak coupling between the tail lobes and the plasma sheet. A straightforward application of small-amplitude oscillation theory shows that the period between onsets is a direct measure of the mean collision frequency in the plasma sheet. The obtained value is in good agreement with that calculated from the resistivity relation. GRA

N80-11696# California Univ., Livermore. Lawrence Livermore Lab.
SEISMIC SAFETY MARGINS RESEARCH PROGRAM OVERVIEW
Frank J. Tokarz and Paul D. Smith 30 Nov. 1978 31 p refs Presented at third ASCE Specialty Conf. on the Structural Design of Nuclear Plant Facilities, Boston, 2 Apr. 1979 Sponsored in part by NUREG
(Contract W-7405-eng-48; DOE-40-550-75)
(UCRL-81884; Conf-790408-4) Avail: NTIS HC A03/MF A01

An overview of the seismic safety margins research program is presented. The program objective, the approach to meet the program goal and objectives, end products, the probabilistic systems methodology, and planned activities for phase 1 are discussed. DOE

N80-11697# Sandia Labs., Albuquerque, N. Mex.
APPROXIMATE METHODS FOR THE ANALYSIS OF EARTH PENETRATION
P. Yarrington and F. R. Norwood 1978 12 p refs Presented at Soc. of Eng. Sci., Gainesville Fla. 4 Dec. 1978
(Contracts EY-76-C-04-0789)
(SAND-78-1748C; Conf-781206-4) Avail: NTIS HC A02/MF A01

Theoretical models of earth penetration are described. These models are incorporated into computer codes which are used to predict penetrator stresses and depth of penetration. The cases of normal and oblique impact are treated and comparisons with full scale experiments are made. DOE

N80-11698# California Univ., Livermore. Lawrence Livermore Lab.
PREDICTING SOLAR ENERGY FLUXES IN POLLUTED URBAN AREAS
T. R. Galloway Apr. 1979 9 p refs Presented at the 14th Intersoc. Energy Conversion Conf., Boston, Mass., 5 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-82080; Conf-790803) Avail: NTIS HC A02/MF A01

A method which utilizes known molecular absorption coefficients for gaseous air pollutants and various manmade and natural aerosols in an urban atmospheric model is presented. The atmospheric optical thickness and thus the ratio of ground level direct incident flux to insolation flux above the atmosphere are predicted. A prediction method for the representative values of the unpolluted air background that was commonly used in the past by the solar energy designer to derive an urban solar energy correction factor is discussed. DOE

N80-11699# Wiggins (J. H.) Co., Redondo Beach, Calif.
SEISMIC SAFETY MARGINS RESEARCH PROGRAM. PHASE 1, PROJECT 7: SYSTEMS ANALYSIS SPECIFICATIONS OF COMPUTATIONAL APPROACH
J. D. Collins Feb. 1979 166 p refs
(Contract W-7405-eng-48)
(UCRL-13986-1) Avail: NTIS HC A09/MF A01

A computational methodology is presented for the prediction of core melt probabilities in a nuclear power plant due to earthquake events. The proposed model has four modules: seismic hazard, structural dynamic (including soil-structure interaction), component failure and core melt sequence. The proposed modules would operate in series and would not have to be operated at the same time. The basic statistical approach uses a Monte Carlo simulation to treat random and systematic error but alternate statistical approaches are permitted by the program design. DOE

N80-11700# General Atomic Co., San Diego, Calif.
SOILST: A COMPUTER PROGRAM FOR SOIL-STRUCTURE INTERACTIONS ANALYSIS
J. J. Johnson Apr. 1979 150 p refs
(Contract EY-76-C-03-0167-065)
(GA-A-15067) Avail: NTIS HC A07/MF A01

SOILST is a computer program to perform soil-structure interaction analysis. Two types of analysis can be performed: time history analysis by direct integration, and the determination of equivalent modal damping ratios for the coupled soil-structure system. The super-structure dynamic characteristics are defined by the structure's fixed-base eigensystem. The behavior of the supporting soil is defined by frequency independent impedance functions. The theory, user's manual, and listing of the program are presented. DOE

N80-11701# Oak Ridge National Lab., Tenn.
SIMULATION OF LAND-USE PATTERNS AFFECTING THE GLOBAL CARBON CYCLE Ph.D. Thesis
Y. H. Chan, J. S. Olson, and W. R. Emmanuel Jan. 1979 183 p refs
(Contract W-7405-eng-26; ESD-Publ-1273)
(ORNL/TM-6651) Avail: NTIS HC A09/MF A01

Past increase of atmospheric CO2 involves significant contributions from both fossil and nonfossil (biospheric) sources. A simulation model was used to reconstruct changes since 1860 and project four hypothetical future scenarios of CO2 injection to 2460. Nineteen compartments and their exchanges of carbon were considered. Areal extent of tropical forests, other wooded ecosystems, and nonforests were incorporated into the model. Rapidly and slowly exchanging pools of carbon per unit area, and net primary production for each pool and exosystem group, were projected by integrating income loss differential equations numerically using SSMP programming language. Limits of exploitable forest area and biomass were evaluated and found to contribute much less future CO2 than the usable coal, oil, gas, and oil shale. DOE

N80-11702# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
DEVELOPMENT AND TESTING OF EQUIPMENT FOR AEROLOGICAL MEASUREMENTS ON BOARD SMALL ROCKETS AND AIR-DROPPED OBJECTS Final Report
Georg Pfotzer Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1978 65 p refs In GERMAN; ENGLISH summary

(Contract BMFT-WRT-69)
(BMFT-FB-W-78-11) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Eggenstein-Leopoldshafen, West Ger. DM 13.50

Results of studies and experimental investigations on methods of aerological measurement on board small rockets are reported. The development and construction of a system for position finding of a fast moving object by the combination of a radiointerferometer for the direction finding and a device for the measurement of the distance via the time delay between signals transmitted from ground and retransmitted by a converter aboard the flying object is described. A study on a special kind of accelerometer, to be inserted in falling spheres or satellites for the measurement of air density, whereby a spherical body inside of the freely moving object is restored by magnetic or electric forces, is presented. The construction of a functional model of the magnetic accelerometer is also discussed. A study on the possibility of the determination of the air density by measuring the Rayleigh scattering of artificial light is reported on. The development and construction of a barometer box with lids of metallic coated membranes of quartz glass forming a pressure sensitive condensor is summarized and the investigation of a pressure gage consisting of a gas discharge tube is outlined. Author (ESA)

N80-11703# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
AERONOMICAL SOUNDING ROCKET PROGRAM. RESULTS OF THE FOIL CLOUD EXPERIMENT FLOWN ON THE PAYLOAD B1 OF THE NATIONAL AERONOMY PROGRAM WINTER ANOMALY AND TRACE CONSTITUENTS AT EL AERNOSILLO, SPAIN, DECEMBER 1975 TO FEBRUARY 1976 Final Report
Hans-Ulrich Widdel Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 64 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRK-0274; DFVLR-BPT-01-D1-173)
(BMFT-FB-W-78-16) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 13.45

The results of a foil cloud experiment executed during the National Aeronomy Program Winter Anomaly and Trace Constituents from December 1975 until February 1976 over E1 Arenosillo are reported. The experiment was flown on small rockets (SKUA 2 and SKUA 3). The experiment was designed for the measurement of the wind profile in the height region 80 to 95 km, providing a high resolution of height and yielding air density measurements. When the campaign results were compared with results of earlier measurements it was found that the sensitive levels, in which a change of wind speed correlates significantly with a change of short wave absorption are about 3 to 6 km higher under conditions of low sunspot activity than is the case when the sun's activity is high. However, the air pressure, derived from the fall rates of the foil cloud, does not change appreciably with the activity of the sun. Author (ESA)

N80-11704# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
AERONAUTICAL SOUNDING ROCKET PROGRAM. RESULTS OF GROUND-BASED SHORT WAVE ABSORPTION MEASUREMENTS PERFORMED AT 38 DEG NORTHERN LATITUDE BETWEEN 1967 AND 1976 Final Report
Hans-Ulrich Widdel Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 73 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRK-0274; DFVLR-BPT-01-OW-015)
(BMFT-FB-W-78-22) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 15.15

Radio wave absorption measurements were taken in different places in Spain. The results are discussed in relation to meteorological processes taking place at D-region heights of the ionosphere. The experimental setup, including sending and receiving antennas, power supplies, ionosondes, and data handling is described. Results, particularly those related to the winter anomaly, are discussed point by point. Emphasis is on the winter anomaly structure, its two year cycle, its intensity, and the apparent correlation with solar activity as well as on magnetic field disturbances and their parallel atmospheric parametric changes. Author (ESA)

N80-11705# Stockholm Univ. (Sweden). Dept. of Meteorology.
PHYSICAL AND CHEMICAL PROPERTIES OF AEROSOLS UNDER VARYING EUROPEAN INFLUENCE
Jost Heintzenberg, Claes Traegaardh, G. Alm, R. Bostroem, L. Granat, H-C. Hansson (Lund. Inst. of Technol., Sweden), B. Holm, S. Moritz, A. Richter, and R. Soderlund 6 Feb. 1979 111 p refs Prepared in cooperation with Intern. Meteorol. Inst.
(AC-48) Avail: NTIS HC A06/MF A01

In a joint field experiment in Velen, southern Sweden, physical and chemical aerosol properties in air masses with varying degrees of contamination were measured. By means of trajectory calculations the aerosol properties were related to air mass in order to study the influence of different source regions. During the total time period a wide range of air masses passed over the station. Consequently aerosol properties varying by factors between 5 and 1000 were encountered. Maximum light scattering and light absorption occurred at the same time as maximum particle concentrations as well as NH4 and SO4 ionic concentrations. The corresponding trajectories clearly indicated the inflow of air as coming from southeastern or western Europe. For other elements the trajectory analysis pointed to maritime or local Scandinavian sources. Author (ESA)

N80-11706# Stockholm Univ. (Sweden). Dept. of Meteorology.
PARAMETERIZATION OF VERTICAL DIFFUSION IN A DIURNALLY VARYING BOUNDARY LAYER
Gunnar Omstedt 12 Mar. 1979 21 p refs Prepared in cooperation with Intern. Meteorol. Inst.
(DM-27) Avail: NTIS HC A02/MF A01

A one-dimensional time-dependant diffusion model is used to represented a diurnally varying boundary layer. How such a variation affects the daily average vertical flux of a pollutant is studied. The model show that, independent of where the source is located (above or inside the boundary layer) a diurnal variation in the turbulent diffusivity profile makes the 24 hour average vertical flux less than the 24 hour average vertical flux computed with a constant turbulent diffusivity profile with the turbulent diffusivity given by its daily average. To assess this difference the concept of effective turbulent diffusivity is introduced.
Author (ESA)

N80-11707# World Meteorological Organization, Geneva (Switzerland).
THE ATMOSPHERE BOUNDARY LAYER
R. W. Stewart 1979 56 p refs Presented at 3d Intern. Meteorol. Organ. (IMO) Lecture of the 7th WMO Congr., 1975
(WMO-523; ISBN-92-63-10523-5) Avail: NTIS HC A04/MF A01; WMO, Geneva SWFR 20

The definition of the atmospheric boundary layer is discussed. Its importance to the dynamics of the atmosphere is pointed out. The exchange of heat and water vapor between the earth's surface and the boundary layer is considered. Stable conditions and their consequences for the concentration of anthropogenic air pollution are examined. The theoretical treatment of the boundary layer, especially as regards mixing properties, is taken up. Various mathematical models, including eddy coefficient theory, similarity theories covering both the surface layer and theory above the surface layer, and closure models, are analyzed for their accuracy and efficiency. The properties of the lower boundary (land and water surfaces) are treated in greater detail and suggestions for further study are made. Author (ESA)

N80-11708# IEA Coal Research, London (England).
CARBON DIOXIDE AND THE GREENHOUSE EFFECT: AN UNRESOLVED PROBLEM
Irene Smith Apr. 1978 40 p refs
(ICTIS/ER-01; ISBN-92-9029-002-1) Avail: NTIS HC A03/MF A01

Current scientific literature concerned with the accumulation of carbon dioxide in the atmosphere is reviewed and evaluated. The extent and possible causes of natural variations in global climate are outlined as a background to potential variations due to human activity. Estimates are given on relative contributions of carbon dioxide to the atmosphere due to fossil fuel combustion, deforestation, and other land modifications. The possibility of a rise in global temperature as a result of increasing the amount

of carbon dioxide in the atmosphere is discussed including model predictions, natural factors which could compensate for or emphasize a warming effect, and the implications if extensive warming actually occurred. It is concluded that there is no evidence of a rise in global temperature due to carbon dioxide at present. An increase in the global temperature in the next century is considered in terms of an increase in precipitation rate and melting of all the ice sheets. Author (ESA)

N80-11709# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
THE EFFECT OF THE MAGNETOSPHERE PROCESSES ON THE IONOSPHERE DURING THE MAGNETIC STORM OF DECEMBER 1, 1977 BASED ON THE COSMOS-900 DATA
E. N. Sosnovets, V. V. Afonin, G. L. Gdalevich, A. V. Dronov, V. D. Ozerov, M. I. Panasyuk, L. V. Tverskaya, V. I. Tulupov, O. V. Koroshevа, and J. Smilauer 1979 12 p refs
(D-277) Avail: NTIS HC A02/MF A01

The effect of the magnetospheric disturbances on the high latitude ionospheric plasma during the magnetic storm of December 1, 1977 was investigated using data from measurements onboard Cosmos 900 satellite. (The circular orbit is at the height of about 500 km, its inclination is 83 deg, the orbit period is 94.4.) The regions of energetic electron precipitation are correlated with auroras and with the intensity of protons forming the storm ring current, and the dynamics of the main ionospheric trough and the polar peaks of the density and the temperature of the ionospheric plasma are studied. Author (ESA)

N80-11710# Geological Survey, Indianapolis, Ind. Water Resources Div.
EFFECTS OF PUMPING ON GROUND-WATER LEVELS NEAR, TAYLORSVILLE, BARTHOLOMEW COUNTY, INDIANA Final Water Resources Investigations.
Michael Planert and Patrick Tucci Feb. 1979 28 p refs
(PB-298244/5; USGS/WRD/WRI-79/018; USGS/WRI-79-20) Avail: NTIS HC A03/MF A01 CSCL 13B

A two-dimensional digital flow model was used to estimate the effects of continuous pumping of a public-supply well field on the ground-water levels near Taylorsville, Indiana. Results of the modeling showed that the water levels would decline from less than 1 to about 4.5 feet within the study area and a maximum of 1 to 2 feet in Taylorsville in response to a pumping rate of 700 gallons per minute. Model results also show that the groundwater system would reach steady state in approximately 5 years after pumping begins. Corrections applied to water-level declines indicated by the model, to account for the effects of partial penetration of the aquifer by wells, showed that these effects, although substantial in the pumping wells, are negligible 200 feet from the wells. GRA

N80-11711# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
SEISMIC REFRACTION INVESTIGATION OF THE SALTON SEA GEOTHERMAL AREA, IMPERIAL VALLEY, CALIFORNIA M.S. Thesis
Robert Frith Bruce Dec. 1978 106 p refs
(Grant NSF AER-72-03551)
(PB-296547/3; UCR/IGPP-78/19; NSF/RA-780511) Avail: NTIS HC A06/MF A01 CSCL 08G

Seven seismic refraction profiles and four long refraction shots were used to investigate the Salton Sea geothermal in preparation for energy resource development. From the data, two models of the geothermal and adjacent area were proposed. GRA

N80-11712# Colorado State Univ., Fort Collins. Dept. of Atmospheric Sciences.
CONVECTION INDUCED TEMPERATURE CHANGE IN GATE
Pamela G. Grube Feb. 1979 138 p refs
(Grants NSF ENV-77-10229; NSF ATM-78-01640)
(PB-298130/6; AS-Paper-305) Avail: NTIS HC A07/MF A01 CSCL 04A

An analysis is made of GATE B-array short time resolution (3-6 hours) upper tropospheric temperature and moisture changes. Convective patterns are examined to determine how deep-cumulus clouds are related to such upper level changes. Thermodynamic characteristics of a raining area are compared to those of a nonraining area. Information is obtained from the B-array rawinsonde, rain gauge, and weather radar products. The magnitude and time-scales of cumulus warming events are discussed as well as how cumulus warming may be related to tropical cyclone genesis. GRA

N80-11713# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
COMPARISON OF SPECTROSCOPIC AND RADIOMETRIC MEASUREMENTS OF UPPER ATMOSPHERE WATER VAPOR
Ira G. Nolt, James V. Radostitz, Russell J. Donnelly, and Lois P. Stearns May 1979 24 p refs Prepared in cooperation with Oregon Univ., Eugene
(PB-299072/9; NOAA-TR-ERL-406; APCL-44;
NOAA-79071308) Avail: NTIS HC A02/MF A01 CSCL 04A

Simultaneous spectroscopic and radiometric measurements of atmospheric water vapor overburden are compared. The measurements taken during 15 flights indicated that both techniques give the same water vapor overburden to within 1 micrometer of precipitable water vapor. The median water vapor overburden is 6.5 micrometers precipitable water vapor at 41,000 ft (approx 180 mbar pressure) in the midlatitude western United States during the summer-fall season, with a range from 4 to 11 micrometers. GRA

N80-11714# Meteorology Research, Inc., Altadena, Calif.
RADAR ECHO ORGANIZATION AND DEVELOPMENT IN THE MESOSCALE ENVIRONMENT: A CASE STUDY APPROACH
P. C. Chen, M. E. Humbert, and T. B. Smith Sep. 1978 98 p refs
(Contract DI-14-06-D-7587)
(PB-298444/1; MRI-78-FR-1580; TDWR/LP-97) Avail: NTIS HC A05/MF A01 CSCL 04A

The relationship between the mesoscale organization and development of clouds (echoes) and the environmental atmospheric conditions is examined. The synoptic conditions, the convective stability, wind shear and wind structure as well as the organization, movement, and evolution of echoes as shown by the M-33 radar are analyzed. GRA

N80-11528# Joint Publications Research Service, Arlington, Va.
EARTH'S CRUST UNDER THE OCEANS
G. B. Rundnik and G. J. Kashintsev *In its* Geophys., Astron. and Space, No. 450 (JPRS-73947) 2 Aug. 1979 p 7-15 refs Transl. into ENGLISH from Priroda (Moscow), no. 4, 1979 p 42-47 (For primary document see N80-11527 02-42)
Avail: NTIS HC A03/MF A01

N80-11529# Joint Publications Research Service, Arlington, Va.
OBSERVATIONS OF ATMOSPHERIC DUST FROM SPACE
Al. Grigoryev and K. Kondratyev *In its* Geophys., Astron. and Space, No. 450 (JPRS-73946) 2 Aug. 1979 p 29-37 refs Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 6, 1979 p 88-92 (For primary document see N80-11527 02-42)
Avail: NTIS HC A03/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-11715# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
WIND SHEAR HAZARD DEFINITION FOR A WIDE BODY JET Final Report
Herbert W. Schlickenmaier Jun. 1979 80 p ref
(FAA-RD-79-90) Avail: NTIS HC A05/MF A01

A computer program is developed to simulate the flight dynamics and automatic flight control system (AFCS) of a three engine jumbo jet following a 3 deg glideslope during final approach.

Wind shear profiles representative of actual encounters are used. The simulation uses both autopilot and autothrottle. An initial effort is made to define specific wind shear conditions that pose hazards to aircraft. Parameter values are analyzed for each of four categorized wind shear environments and performance scores achieved on computer simulations are assigned for each of the four wind shear types. The most severe situations that can be accommodated by a jumbo tri-jet with current configuration are described for each of the four wind shear types. Conservative controllability criteria is applied and a hazardous condition is presumed to exist when the control action demanded and provided by the simulator exceeds the control limits of the actual aircraft, or when the airspeed and/or touchdown dispersion exceed limit values. Definition of these criteria provide a basis for the formulation of procedures allowing aircraft to anticipate and avoid hazardous wind shear conditions. A.R.H.

N80-11716*# Naval Weapons Center, China Lake, Calif.
AIRBORNE MEASUREMENTS OF CLOUD FORMING NUCLEI AND AEROSOL PARTICLES AT KENNEDY SPACE CENTER, FLORIDA
Lawrence F. Radke, Gerhard Langer, and Edward E. Hindman, III Dec. 1978 33 p refs Sponsored in part by NSF Prepared in cooperation with Washington Univ., Seattle and National Center for Atmospheric Research, Boulder, Colo.
(Contract NASA Order T-6782-F; Contract N60530-78-C-0114)
(NASA-CR-160359; NWC-TM-3667) Avail: NTIS
HC A03/MF A01 CSCL 04B

Results of airborne measurements of the sizes and concentrations of aerosol particles, ice nuclei, and cloud condensation nuclei that were taken at Kennedy Space Center, Florida, are presented along with a detailed description of the instrumentation and measuring capabilities of the University of Washington airborne measuring facility (Douglas B-23). Airborne measurements made at Ft. Collins, Colorado, and Little Rock, Arkansas, during the ferry of the B-23 are presented. The particle concentrations differed significantly between the clean air over Ft. Collins and the hazy air over Little Rock and Kennedy Space Center. The concentrations of cloud condensation nuclei over Kennedy Space Center were typical of polluted eastern seaboard air. Three different instruments were used to measure ice nuclei: one used filters to collect the particles, and the others used optical and acoustical methods to detect ice crystals grown in portable cloud chambers. A comparison of the ice nucleus counts, which are in good agreement, is presented. Author

N80-11717# RAMCOR, Inc., Vienna, Va.
A REPORT ON ATMOSPHERIC OBSTRUCTIONS TO VISIBILITY. VOLUME 1: STUDY RESULTS Final Report
Victor J. Lugetic 10 Mar. 1979 115 p
(Contract DAAK70-78-C-0109)
(AD-A071741; RC168-001-Vol-1; ETL-0169) Avail: NTIS
HC A06/MF A01 CSCL 04/2

The aims and objectives of this report were to collect and assimilate information and synthesize data on the effects of atmospheric obstructions to visibility for the non-specialist. The following areas were addressed: A general discussion of the visible wavelengths, overall electromagnetic spectrum, radiometric and photometric quantities and concepts, and other visibility parameters; The human eye, nature of visibility, and the atmospheric effects on detection ranges; A description of those obstructions to visibility as listed in the Federal Meteorological Handbook on surface observations; A description of the primary visual instruments; The practicality of developing techniques that could be used to determine the effects of atmospheric obstructions on visibility and some typical charts and graphs; and, A summary of the extensive literature search performed. GRA

N80-11718# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19305A GSRS MISSILE NUMBER 1025, ROUND NUMBER V-33
May 1979 19 p
(DA Proj. 1T6-65702-D-126)
(AD-A071894; ERADCOM/ASL-DR-1021) Avail: NTIS
HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19305A GSRS, Missile No. 1025, Round No. V-33, are presented in tabular form. GRA

N80-11719# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19305A GSRS MISSILE NUMBER 1055 ROUND NUMBER V-31
May 1979 19 p
(DA Proj. 1T1-66572-D-126)
(AD-A071880; ERADCOM/ASL-DR-1019) Avail: NTIS
HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19305A GSRS, Missile No. 1055, Round No. V-31, are presented in tabular form. GRA

N80-11720# Eastman Kodak Co., Rochester, N. Y. Apparatus and Optical Div.
SPECTRAL RADIOMETRIC MEASUREMENT AND ANALYSIS PROGRAM. VOLUME 4: SCAT3 OPERATOR'S MANUAL Final Report
L. G. Christensen, R. Simmons, G. Schauss, R. Norton, and R. Schoenfeld Apr. 1979 57 p
(AD-A072081; AWS-TN-79-001-Vol-4) Avail: NTIS
HC A04/MF A01 CSCL 04/2

This report covers a recently completed contract with the United States Air Force Air Weather Service to conduct research into the transfer of atmospheric energy in the visible and near-infrared portions of the electromagnetic spectrum. Its objective was to produce a spectral model of path transmittance, radiance, and groud-level irradiance that could be related to meteorological observations through the use of simultaneous, insitu data collections. For this purpose, a mathematical model was developed. It was based on physical equations for a homogeneous atmosphere that were modified by empirical observations made under a broad range of meteorological conditions. With the model, it is possible to estimate the visible and near-infrared spectral absorption and scattering phenomena that result from atmospheric constituents, from surface synoptic weather observations. The atmospheric model was coded into a computer program called SCAT3. This document is the fourth volume documenting the radiometric data collection program that culminated in the radiometric atmospheric model, SCAT3. The objective of this volume is to acquaint the user with the proper input sequences and options when SCAT3 is run on an IBM 370 computer. Volumes, 1, 2, and 3 contain the details of data collection, analysis, and derivation of equations that were coded into the program to reconstruct atmospheric radiance, transmittance, and ground irradiation. GRA

N80-11721# Eastman Kodak Co., Rochester, N. Y. Apparatus and Optical Div.
SPECTRAL RADIOMETRIC MEASUREMENT AND ANALYSIS PROGRAM. VOLUME 3: DATA ANALYSIS AND FORMULATION OF THE MODEL Final Report
L. G. Christensen and R. Simmons Apr. 1979 225 p refs
(AD-A072080; AWS-TN-79-001-Vol-3) Avail: NTIS
HC A10/MF A01 CSCL 04/2

This report covers a recently completed contract with the United States Air Force Air Weather Service to conduct research into the transfer of atmospheric energy in the visible and near-infrared portions of the electromagnetic spectrum. Its objective was to produce a spectral model of path transmittance, radiance, and ground-level irradiance that could be related to meteorological observations through the use of simultaneous, insitu data collections. For this purpose, a mathematical model was developed. It was based on physical equations for a homogeneous atmosphere that were modified by empirical observations made under a broad range of meteorological conditions. With the model, it is possible to estimate the visible and near-infrared spectral absorption and scattering phenomena that result from atmospheric constituents, from surface synoptic weather observations. This document presents the details of analysis used to reduce the collected radiometric and meteorological data to a series of equations which became the SCAT3. Examples are also shown illustrating the final model's ability to match observed spectral structure based upon coefficients derived from surface meteorology. GRA

N80-11722# Eastman Kodak Co., Rochester, N. Y. Apparatus and Optical Div.

SPECTRAL RADIOMETRIC MEASUREMENT AND ANALYSIS PROGRAM. VOLUME 1: DESCRIPTION OF MOBILE RADIOMETRIC LABORATORY SYSTEM Final Report

Lawrence G. Christensen, R. Simmons, G. Schauss, R. Norton, and R. Schoenfeld Apr. 1979 98 p

(AD-A072078; AWS-TN-79-001-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 04/2

This report covers a recently completed contract with the United States Air Force Air Weather Service to conduct research into the transfer of atmospheric energy in the visible and near-infrared portions of the electromagnetic spectrum. Its objective was to produce a spectral model of path transmittance, radiance, and ground-level irradiance that could be related to meteorological observations through the use of simultaneous, in-situ data collections. For data collection, a self-sustaining, mobile, field radiometric laboratory was used that contained custom-designed spectroradiometers, mechanical/electrical servo controls, and computer interfaces; the laboratory utilized computer software for laboratory operation and data analysis. By means of minicomputers and peripherals, the laboratory produced calibrated and corrected data that could later be processed on larger, in-house IBM systems for development of the final radiometric model. This volume (No. 1) provides an engineering description of the mobile laboratory, the calibration of radiometers, and the computer software developed to operate the laboratory. More detailed documentation of devices and software is available upon request that will permit better understanding of the details of electronic, mechanical, and optical operation and maintenance of the laboratory system. This related system documentation is listed in Appendix A of this volume. Author (GRA)

N80-11723# Weather Wing (3rd), Offutt AFB, Nebr. Aerospace Sciences Div.

MAJOR MIDWEST SNOWSTORMS

Eugene M. Weber 8 Aug. 1979 104 p Supersedes Rept-3WW-TN-76-2-Rev

(AD-A072746; Rept-3WW-TN-79-2; Rept-3WW-TN-76-2) Avail: NTIS HC A06/MF A01 CSCL 04/2

This Technical Note discusses the various atmospheric conditions essential to the development of major wintertime storm systems over the Midwest (Central United States). Primary emphasis is placed upon determination of areas favorable for cyclogenesis. Intensification and movement of the 500 mb low as a function of 500 mb height falls tendency is presented. Identification, intensification, and movement of the main surface system is then introduced. Finally, the related developments of all levels of the atmosphere, as they occurred, are shown in various summary forms. Author (GRA)

N80-11724# Naval Research Lab., Washington, D. C.

FIELD TEST OF THE STABILIZATION OF SUPERSIZED WATER DROPLETS CONDENSED ON PYROTECHNICALLY GENERATED HYGROSCOPIC NUCLEI

S. G. Gathman, B. G. Julian, R. K. Markson (Airborne Research Associates, Weston, Mass.), and J. Sedlacek (Airborne Research Associates, Weston, Mass.) 10 Aug. 1979 29 p refs

(AD-A073035; NRL-MR-4059) Avail: NTIS HC A03/MF A01 CSCL 04/2

A field experiment is described which was undertaken to determine if water droplets grown on pyrotechnically generated hygroscopic nuclei at high relative humidities can be stabilized in size when exposed to lower ambient relative humidities. Droplets coated with surface active materials were observed to persist longer than untreated droplets in identical experiments performed off of Nantucket, Massachusetts. GRA

N80-11725# Meteorology International, Inc., Monterey, Calif.

THE APPLICATION OF MEASURES OF SYNOPTIC SIMILARITY TO THE EVALUATION AND DEVELOPMENT OF ATMOSPHERIC PREDICTION MODELS: TASK 1 Final Report

Manfred M. Holl and Michael J. Cuming Monterey, Calif. Dept. of the Navy Mar. 1979 93 p refs

(Contract N00228-78-C-3258)

(AD-A073098; MII-M-238; NEPRF-CR-79-01) Avail: NTIS HC A05/MF A01 CSCL 04/2

A method is described for bit-coding meteorological analyses and forecasts in terms of specifying parameters which measure pattern characteristics. By matching the associated bit strings, an absolute measure of the similarity between forecast and analyzed synoptic fields can be obtained. Applications to numerical model verification, evaluation and development are discussed. GRA

N80-11726# Air Force Geophysics Lab., Hanscom AFB, Mass.

SHORTRANGE FORECASTING THROUGH EXTRAPOLATION OF SATELLITE IMAGERY PATTERNS. PART 1: MOTION VECTOR TECHNIQUES

H. Stuart Muench and Rupert S. Hawkins 26 Apr. 1979 22 p refs

(AF Proj. 6670)

(AD-A073081; AFGL-TR-79-0096; AFGL-ERP-660) Avail: NTIS HC A02/MF A01 CSCL 04/2

The advent of the geosynchronous satellite with 1 km resolution has presented meteorologists with the opportunity to routinely track and forecast smaller scale weather phenomena than hitherto was possible. The enormous data rate, however, precludes a completely manual system of data interpretation and forecasting, so to fully utilize this opportunity we must use computers. Following examples set by forecasters using digitized radar data, we are developing techniques to make guidance forecasts through automatic extrapolation of satellite imagery. Candidate techniques for extracting motion vectors from satellite imagery have been selected and programmed. This report describes the techniques and presents results of a preliminary test using simulated motions of selected satellite video images. GRA

N80-11727# Air Force Geophysics Lab., Hanscom AFB, Mass.

DESIGN STUDY FOR THE DEVELOPMENT AND USE OF MODEL OUTPUT STATISTICS IN AUTOMATED AVIATION WEATHER FORECASTING Final Report, 1 Apr. 1976 - 30 Sep. 1978

Harry R. Glahn and Karl F. Hebenstreit 1 Dec. 1978 38 p refs

(AF Proj. 6670)

(AD-A072849; AFGL-TR-79-0002) Avail: NTIS HC A03/MF A01 CSCL 04/2

The Air Weather Service is preparing for the WWMCCS era by developing a support concept whereby weather information inputs will be in terms of Weather Impact Indicators (WIIs) which specify the probability that all stages of a mission will have 'favorable' weather. This report presents the design of a system based on the proven Model Output Statistics (MOS) approach to provide, in real-time, acceptably skillful objective estimates of WII probabilities. The system is mission oriented allowing the user to specify the limiting values for the weather elements which impact his mission. If forecast equations for such a mission profile are not already available in the system, forecast equations will be developed, applied, and archived for future use. Acceptable accuracy of these forecasts is essential. A user will not be satisfied with probabilities which, through poor reliability, lead to unexpected losses or which, through poor resolution, furnish little discrimination over and above a simple application of climatology. The design analysis for a real-time MOS system for global application shows such a system to be feasible within the resources of a large-scale computing center such as that operated by the National Oceanic and Atmospheric Administration or the Air Force Global Weather Central. GRA

N80-11728# California Univ., Livermore. Lawrence Livermore Lab.

COMPARISON OF THE FINITE ELEMENT AND FINITE DIFFERENCE METHODS IN A DIAGNOSTIC REGIONAL WIND FIELD MODEL M.S. Thesis

Daniel Joseph Rodriguez May 1979 97 p refs

(Contract W-7405-eng-48)

(UCRL-52789) Avail: NTIS HC A05/MF A01

A comparative study was undertaken to investigate the similarities and differences between the finite element and finite difference methods of numerically approximating an objective analysis equation. Both models are three-dimensional, time-independent, and incorporate terrain in adjusting a field of observed three-component velocities to achieve mass-consistency. Principles from the calculus of variations are utilized in developing model equations. The variational approach assumes that velocities

input to the models are a fair representation of actual mean winds. Starting with meteorological data available randomly on a regional scale, wind component values are interpolated and extrapolated to each grid point in the calculational domain in a manner consistent with prevailing meteorology. Model adjustments are made in response to the original mass-inconsistency in this field of discrete velocities and to the topographical boundary surface representing the application area. DOE

N80-11729# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
SATELLITE SUPPORT TO HIPLEX: SUMMARY OF RESULTS, 1976 - 1978 Final Report, 2 Dec. 1975 - 30 Sep. 1978
David W. Reynolds and Thomas H. VonderHaar Feb. 1979 207 p refs
(Contract DI-6-07-DR-20020)
(PB-297839/3) Avail: NTIS HC A10/MF A01 CSCL 04B

Research in the use of satellite digital imagery in support of the High Plain Cooperative Program (HIPLEX) during the period 1976-1978 is presented. In general, the report is divided into two main sections. Satellite determined cloud climatologies gathered during the past several HIPLEX seasons and intensive case study analyses are reported. A description of the CSU All Digital Video Imaging System for Atmospheric Research (ADVISAR) and the Direct Readout Satellite Groundstation (DRSGS) facilities is included. GRA

N80-11730*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
INTERANNUAL VARIABILITY OF THE OCEAN ATMOSPHERE SYSTEM
1978 15 p refs Presented at the Symp. on Solar-Terrestrial Phys., Innsbruck, 29 May 1978
(Grants NGR-06-002-098; EY-76-S-02-1340; NSF ATM-76-21017; Contract N00228-76-C-3205)
(NASA-CR-162456; COO-1340-64; Conf-780598) Avail: NTIS HC A02/MF A01 CSCL 04B

Feedback mechanisms between the ocean and atmosphere are discussed. The influence of these mechanisms on the interannual variability of the atmosphere and on climatic fluctuations are examined. Large sea surface temperature anomalies which influence weather patterns by influencing planetary long waves are discussed. A.W.H.

N80-11731# World Meteorological Organization, Geneva (Switzerland).
FIRST SESSION OF THE WAMEX SCIENTIFIC AND MANAGEMENT REGIONAL COMMITTEE Global Atmospheric Research Program
1978 62 p refs In FRENCH and ENGLISH Conf. held at Ibadan, Nigeria, 6-10 Nov. 1978 Prepard jointly with ICSU, Rome
(GARP-Spec-Rept-31) Avail: NTIS HC A05/MF A01

The status of the West African Monsoon Experiment (WAMEX), which is part of the GARP Monsoon Sub-Program, is reported on. The WAMEX implementation and operations plan is discussed in detail. The WAMEX observing system, data management, and the commitments and activities of the WAMEX participating countries are described. Scientific planning, research aspects of WAMEX, and public information activities related to WAMEX are also covered. Author (ESA)

N80-11732# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: CONSOLIDATED REPORT ON THE VOLUNTARY ASSISTANCE PROGRAMME INCLUDING PROJECTS APPROVED FOR CIRCULATION IN 1978 Annual Report
Jan. 1979 415 p
(WMO-525; ISBN-92-63-10525-1) Avail: NTIS HC A18/MF A01; WMO, Geneva SWFR 15

The voluntary assistance Program (VAP) as part of the World Weather Watch (WWW) plan is reported. The purpose of VAP is to provide assistance ot participating countries in the implementation of the WWW plan, the financing and training of staff, and in the application of WWW in the field of hydrology. Suggestions on the form of notification of contribution of equipment and services to the VAP to be used are given. The status of the program to date is recapitulated and broken down by country. Author (ESA)

N80-11733# World Meteorological Organization, Geneva (Switzerland).
[REPORT OF ACTIVITIES ON WORLD METEOROLOGICAL RESEARCH, APPLICATIONS AND WATER RESOURCES DEVELOPMENT] Annual Report, 1978
1979 236 p
(WMO-529; ISBN-92-63-10529-4) Avail: NTIS HC A11/MF A01

Activities in such areas as water resources, agrometeorology and world food production, natural disasters and environmental problems of various kinds relating to weather modification, ozone depletion, atmospheric and marine pollution; and wind and solar energy are reported. The launching of the Global Weather Experiment is extensively covered. Meteorological applications in improving man's environment are emphasized. Progress made in hydrology and water resources development on regional and global levels along with the development programs of other organizations is discussed. A technical cooperation program through which assistance is rendered to developing countries is also summarized. Author (ESA)

N80-11734# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE FIFTEENTH SESSION OF THE JOINT ORGANIZING COMMITTEE Global Atmospheric Research Program Annual Report
1979 184 p refs Conf. held at Dubrovnik, Yugoslavia, 28 Feb. - 6 Mar. 1979 Prepared jointly with ICSU, Rome
Avail: NTIS HC A09/MF A01; WMO, Geneva SWFR 25

The status of the Global Experiment, the GARP climate dynamics subprogram, the World Climate Research Program, and other GARP subprograms is reported. Progress made by the Working Group on Numerical Experimentation is also cited. These activities cover such research areas as oceanography and climate, the carbon dioxide problem, climate modeling, the parameterization of extended cloudiness and radiation, as well as oceanic processes and observation of the world ocean. Author (ESA)

N80-11735# Fondazione Ugo Bordoni, Rome (Italy).
PLUVIOMETRIC DATA PRINTER [STAMPANTE DATI PLUVIOMETRIC]
Paolo Giorgi Dec. 1978 26 p refs In ITALIAN; In ITALIAN; ENGLISH summary
(FUB-25-1978) Avail: NTIS HC A03/MF A01

A data printer of pluviometric data was developed in order to satisfy the requirements of a research project on the effects of rainfall on electromagnetic wave propagation above 10 GHz. The apparatus makes possible telemetric real time measurements, avoiding long processing delays. The characteristics of the logic circuits, power supply, and printer, are described. Author (ESA)

N80-11736# Royal Netherlands Meteorological Inst., De Bilt.
THE CALCULATION OF EVAPOTRANSPIRATION USING THE PENMAN FORMULA [TOEPASSINGEN VAN DE PENMAN FORMULE]
H. A. R. deBruin and W. Kohsiek 1979 57 p refs In DUTCH; ENGLISH summary
(KNMI-WR-79-3) Avail: NTIS HC A04/MF A01

The application of the Penman equation for determining evapotranspiration, both for wet vegetation and for open surface water, is considered. Attention is payed to heat storage in the body of water, estimation of net radiation, and to the function describing the turbulent exchange in the atmosphere of water vapor and sensible heat. A brief error analysis is also given. The example of a crop surface is then treated. Results show that uncertainties in the wind function have a severe influence on the calculated evaporation. It is shown that uncertainties in the wind velocity at 2 m above a crop surface, derived from observations at neighboring meteorological stations, may lead to errors of up to 10% of the magnitude of the wind function. Finally, the effect of different averaging procedures on the water vapor pressure deficit is discussed. Author (ESA)

N80-11737# Royal Netherlands Meteorological Inst., De Bilt.
A CLIMATOLOGICAL STUDY ON THE OCCURRENCE OF EASTERLY GALES ON THE NORTH ATLANTIC OCEAN
C. G. Korevaar 1979 72 p refs
(KNMI-WR-79-5) Avail: NTIS HC A04/MF A01

The number of easterly gales that occurred in the North Atlantic Ocean north of 25 deg N were estimated using a selection criterion involving minimum values for the meridional pressure gradient for each day of the period 1881 to 1970. Looking at the number of days per year on which an easterly gale did occur it is seen that there are considerable differences between the successive periods 1881 to 1900, 1901 to 1920, 1921 to 1940, and 1941 to 1960. The fluctuations in the number of days per year with an easterly gale can be explained by a climatic fluctuation, connected by Willett with the cycle of solar activity, with a period of 80 to 90 years. This is in agreement with the fact that Schuurmans and Willett found the greatest increase in air pressure, after a solar flare, in the areas under consideration. It can be concluded that the occurrence of various numbers of easterly gales during the 80 to 90 year cycle of solar activity is a confirmation of the theories of Willett and Schuurmans. Results also show that next to influencing the frequency, the solar activity influences the persistence and extensiveness of easterly gales.
Author (ESA)

N80-11738# Royal Netherlands Meteorological Inst., De Bilt.
VERIFICATION OF TWELVE AND 24 HOUR GEOSTROPHIC WIND FORECASTS AT 850 mbar USING BK3 AT IJMUIDEN OVER THE PERIOD OF 1 OCTOBER 1972 TO 30 NOVEMBER 1976 [VERIFICATIE VAN 12- EN 24 UURS GEOSTROFISCHE WINDVERWACHTINGEN OP 850 mbar VAN BK3 VOOR IJMUIDEN OVER DE PERIODE 1 OKTOBER 1972 T/M 30 NOVEMBER 1976]
L. C. Heijbor and G. W. Brouwer 1979 43 p refs In DUTCH; ENGLISH summary
(KNMI-WR-79-7) Avail: NTIS HC A03/MF A01

Verifications were carried out using geostrophic wind forecasts from an operational three-level quasi-geostrophic numerical model, BK3, and from the forecasts of the persistence. Contingency tables were composed for the forecasts of the wind speeds. With the aid of these tables the indices of the performance (relative performance of the model compared to the climatology) and skill scores (relative performance compared to the forecasted persistence) were computed. The forecasts of the wind directions were verified by taking the differences between the forecasted and observed directions and computing the mean differences and standard deviations for all chosen classes of forecasted wind speeds. Results show that the predictions of BK3 were better than those of the forecasted persistence.
Author (ESA)

N80-11739# National Technical Information Service, Springfield, Va.
FOG PREDICTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978
Guy E. Habercom, Jr. Aug. 1979 178 p Supersedes NTIS/PS-77/0799; NTIS/PS-76/0635; NTIS/PS-78/0775 (NTIS/PS-79/0820/5; NTIS/PS-78/0775; NTIS/PS-77/0799; NTIS/PS-76/0635) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Methods for predicting the possibility of fog formation and forecasting the eventual natural dissipation of fog are investigated. Worldwide climatic conditions conducive to the probability of fog in specific geographic areas are observed. This updated bibliography contains 169 abstracts, 4 of which are new entries to the previous edition.
GRA

N80-11740# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
THE DYNAMICS OF EQUATORIAL MASS-FLOW ADJUSTMENT
Pedro Leite Silva Dias Jun. 1979 218 p refs
(Grants NSF ATM-76-09370; NSF ATM-78-08125)
(PB-297992/0; ATS/Paper-312) Avail: NTIS HC A10/MF A01 CSCL 04B

The problem of the adjustment of the mass and wind fields in a divergent barotropic model is solved on the equatorial beta-plane. It is also shown that the concept of an adjusted state on the beta-plane is dependent on the dispersive properties and energetics of Rossby and gravity waves. Two basic experiments are shown: the first is a perturbation in the geopotential field, and the second is a perturbation in the rotational part of the wind field.
GRA

N80-11741# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.
MARINERS WEATHER LOG, VOLUME 23, NUMBER 3
Elwyn E. Wilson May 1979 86 p
(PB-298738/6; NOAA-79061903) Avail: NTIS HC A05/MF A01 CSCL 04B

Mariners Weather Log, volume 23, number 3, discusses marine meteorology in the North Pacific Ocean. Articles include: ship response and environmental ship routing; Eastern North Pacific tropical cyclones, 1978; and Central North Pacific tropical cyclones, 1978.
A.W.H.

N80-11742# National Weather Service, Salt Lake City, Utah. Western Region.
THE DEPTH OF THE MARINE LAYER AT SAN DIEGO AS RELATED TO SUBSEQUENT COOL SEASON PRECIPITATION EPISODES IN ARIZONA
Ira S. Brenner May 1979 25 p refs
(PB-298817/8; NOAA-TM-NWS-WR-143; NOAA-79070602) Avail: NTIS HC A02/MF A01 CSCL 04B

The relationship between the depth of the marine layer at San Diego, California, and potential precipitation episodes in Arizona during the cool season is studied. A marine layer from the surface to at least the 700 mb level is necessary for consideration of a subsequent widespread precipitation episode in Arizona. The relationship of the height of this marine inversion to the current vertical motion field is discussed.
GRA

N80-11743# National Weather Service, Salt Lake City, Utah. Western Region.
THE USEFULNESS OF DATA FROM MOUNTAINTOP FIRE LOOKOUT STATIONS IN DETERMINING ATMOSPHERIC STABILITY
Jonathan W. Corey May 1979 14 p refs
(PB-298899/6; NOAA-TM-NWS-WR-142; NOAA-79070601) Avail: NTIS HC A02/MF A01 CSCL 04B

A lifted index derived from data taken at several mountaintop fire lookout stations is discussed as a technique for thunderstorm forecasting during the fire season. The procedure for deriving an index of atmospheric temperature and moisture data is described and a discussion of the reliability of the procedure is presented.
A.W.H.

N80-11744# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.
OBJECTIVE USE OF SATELLITE DATA DUE TO FORECAST CHANGES IN INTENSITY OF TROPICAL DISTURBANCES
Carl O. Erickson Apr. 1979 48 p refs
(PB-298915/0; NOAA-TM-NESS-103; NOAA-79070902) Avail: NTIS HC A03/MF A01 CSCL 04B

Eighty-nine classified and unclassified tropical disturbances of all intensities (several hundred synoptic 'cases') were investigated to determine how high-cloud vectors and other satellite data might be used for objective forecasts of changes in intensity. For unclassified (weak) disturbances, a 6-variable discriminator can identify many that are nondeveloping. For the remainder of unclassified disturbances, additional information is needed. For classified disturbances, two modified regression equations were developed to predict the 24 hr change in windspeed. The equations are derived from operationally available data, and the variables are calculated by a relatively simple numerical program. It appears that introduction of low-level vorticity and the nonlinear advection of vorticity should offer further improvements.
GRA

N80-11745# National Weather Service, Silver Spring, Md.
THE NESTED GRID MODEL
Norman A. Phillips Apr. 1979 89 p refs
(PB-299046/3; NOAA-TR-NWS-22; NOAA-79071307) Avail: NTIS HC A05/MF A01 CSCL 04B

The nested grid model, which consists of a stereographic hemispheric grid with the option of one or two interior rectangular grids, each of successively smaller area and finer horizontal

resolution is described. Second order accurate finite difference formulas used in a two step Lax-Wendroff procedure are discussed. Special initial treatments used to reduce spurious gravity waves from the Himalayas, and to insure symmetry about the equator are examined. Details of the September 1978 state of the model and its numerical procedures are presented, including the representation of latent heat release, small scale vertical exchange, spatial filtering, grid meshing at boundaries, and data input from the global analysis system. GRA

N80-11748# New Mexico Univ., Albuquerque. Technology Application Center.
CLEAR AIR TURBULENCE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE
Progress Report, 1974 - Jul. 1979
Samuel C. Mauk Sep. 1979 37 p Sponsored in part by NTIS
(NTIS/PS-79/0858/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 01C

Articles covering research and analysis, theories and experiments, detection and measurement equipment, simulation modeling, and CAT accidents involving aircraft are presented. (Contains 121 citations) GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-11747*# Battelle Columbus Labs., Ohio.
PRELIMINARY ASSESSMENT OF INDUSTRIAL NEEDS FOR AN ADVANCED OCEAN TECHNOLOGY
A. G. Mourad, K. M. Maher, J. E. Balon, A. G. Coyle, and J. A. Henkener 15 Oct. 1979 59 p refs
(Contract NASw-2800)
(NASA-CR-162435; BCL-OA-TFR-79-4) Avail: NTIS HC A04/MF A01 CSCL 08C

A quick-look review of selected ocean industries is presented for the purpose of providing NASA OSTA with an assessment of technology needs and market potential. The size and growth potential, needs and problem areas, technology presently used and its suppliers, are given for industries involved in deep ocean mining, petrochemicals ocean energy conversion. Supporting services such as ocean bottom surveying; underwater transportation, data collection, and work systems; and inspection and diving services are included. Examples of key problem areas that are amenable to advanced technology solutions are included. Major companies are listed. A.R.H.

N80-11748# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
NUMERICAL CASE STUDIES FOR OCEANIC THERMAL ANOMALIES WITH A DYNAMIC MODEL
Joseph Chi Kan Huang 1979 41 p refs Prepared in cooperation with Michigan Univ., Ann Arbor
(AD-A072587) Avail: NTIS HC A03/MF A01 CSCL 08/10

Numerical investigations to identify the physical processes responsible for the generation, evolution, and dissipation of oceanic thermal anomalies (OTA) were carried out using the numerical dynamic model of the North Pacific Experiment (NORPAX). The NORPAX model is based on time-integrations of the finite-difference forms of the primitive equations. It possesses an actual coastal configuration and 10 vertical layers, with a constant maximum depth of 4 km. The horizontal grid spacing, both longitudinal and latitudinal, is 2.5 deg. The seasonally varying model climatology is generated by integrating the model over 80 years of simulations under the climatological atmospheric forcing with the last 20 years varying with the seasonal cycle. Large-scale features of the model ocean climatology compare favorably with observed large-scale motions and structure in the North Pacific Ocean. The model is used for oceanic thermal anomaly studies. Two simulated cases are presented: one demonstrates the generation and evolution of OTA's under anomalous atmospheric wind forcing of winter 1949-50, and the other portrays the evolution and dissipation of the OTA's under climatological atmospheric conditions in winter 1971-72. GRA

N80-11749# Texas A&M Univ., College Station. Dept. of Oceanography.
LONG WAVE COUPLING OF THE MID AND SOUTH ATLANTIC BIGHTS FORCED BY THE ATMOSPHERE
David A. Brooks May 1979 131 p refs
(Contract N00014-77-C-0354; Grant NSF OCE-77-20971)
(AD-A072282; TAMU-Ref-79-3-T) Avail: NTIS HC A07/MF A01 CSCL 08/3

The eastern United States continental margin profile is relatively uniform throughout the Middle Atlantic Bight (Hatteras to Gulf of Maine), but in the South Atlantic Bight (Florida Keys to Hatteras) it bifurcates into an inner and outer slope region. Coastal tide gage records indicate that sea level oscillations with periods longer than one week can propagate southward as continental shelf waves in both Bights, thereby providing a coupling mechanism between the Bights. However, several-day period motions appear to be confined to the South Atlantic Bight and may result from backscattering of long wave energy by the variable topography and the Gulf Stream. The coastal sea level phase data for the several-day period motions is not easily attributable to a monochromatic propagating wave; rather, it appears that wave group properties may lead to a more consistent explanation of the phases. Cross-shelf and longshelf wind stress components were both strongly coupled to sea level fluctuations for long periods; short period motions were more closely associated with dynamic responses to atmospheric pressure fluctuations. GRA

N80-11750# Office of Naval Research, Bay St. Louis, Miss.
PHYSICAL OCEANOGRAPHY PROGRAM Report, FY 1979
Robert G. Kirk 1 May 1979 68 p refs
(RR0310301)
(AD-A073115) Avail: NTIS HC A04/MF A01 CSCL 08/10

This report presents a summary of work sponsored by the Physical Oceanography Program (Code 481) Office of Naval Research, Ocean Science and Technology Detachment, covering the FY 79 period. It includes a brief description of (1) the status of research for each of eleven different areas of physical oceanography, (2) each of the four multi-investigator, multi-institutional, and multidisciplinary projects which ONR 481 jointly sponsors, (3) each of the 79 individual projects which ONR 481 sponsors, and (4) all referred journal articles appearing during FY 1979. GRA

N80-11751# Department of Energy, Washington, D. C. Office of Solar, Geothermal, Electric and Storage Systems.
OCEAN SYSTEMS, PROGRAM SUMMARY
Feb. 1979 260 p refs
(DOE/ET-0083) Avail: NTIS HC A12/MF A01

This program summary describes each of the DOE's Ocean Systems Program projects funded during FY 1978 (October 1, 1977 through September 30, 1978) and reflects their status as of September 30, 1978. The Ocean Systems Program includes ocean thermal energy conversion, wind-wave energy, ocean current energy, and salinity gradient energy. The project summary sheets list the project title, contractor, principal investigator, work location, contract number, DOE funding, and project summary. DOE

N80-11752# Environmental Protection Agency, Annapolis, Md.
BIOCHEMICAL STUDIES OF THE POTOMAC ESTUARY, SUMMER 1978
Joseph Lee Slayton and E. Ramona Trovato May 1979 42 p refs
(PB-297394/9; EPA-903/9-79-005) Avail: NTIS HC A03/MF A01 CSCL 08A

The carbonaceous and nitrogenous oxygen demand of Potomac River and STP effluent samples was determined during the summer of 1978. The oxygen depletion kinetics were studied during long term incubation using an inhibitor to nitrification. The average deoxygenation constants k sub e for the river sample CBOD and NOD were 0.12/day and 0.10/day, respectively. The CBOD of the Potomac STP effluent samples followed first order kinetics with an average k sub = e .16/day. The NOD for the STP effluent samples had a significant lag time resulting in poor correlation coefficients for first order fit. The average algal

contribution to the BOD5 was 0.027 mg/micrograms chlorophyll a with 70 percent due to decay and 30 percent due to respiration. GRA

N80-11753# National Marine Fisheries Service, Galveston, Tex. Galveston Lab.
ENVIRONMENTAL STUDIES OF THE SOUTH TEXAS OUTER CONTINENTAL SHELF, 1977. ICHTHYOPLANKTON/MACKEREL EGGS AND LARVAE Final Report, 1977
John H. Finucane, L. Alan Collins, Lyman E. Barger, and John D. McEachran Apr. 1979 527 p refs Prepared in cooperation with Texas A and M Univ., College Station
(PB-296647/1; BLM/YM/ES-79/07) Avail: NTIS HC A23/MF A01 CSCL 08A

An ichthyoplankton study of the south Texas continental shelf is discussed. The species composition, relative abundance, and seasonal and areal distribution of ichthyoplankton are examined. Spawning times and spawning locations of major fish species are reported and data on the ecology of the area is provided. A.W.H.

N80-11754# National Marine Fisheries Service, Galveston, Tex.
ENVIRONMENTAL STUDIES OF THE SOUTH TEXAS CONTINENTAL SHELF, 1976 - 1977. HISTORICAL ZOOPLANKTON Final Report, 1977
E. Taisoo Park Apr. 1979 568 p refs
(PB-296646/3; BLM/YM/ES-79/06) Avail: NTIS HC A24/MF A01 CSCL 08A

Monthly samples taken off the South Texas coast between 1963 and 1965 were used to examine temporal and spatial variability in zooplankton populations. These data were compared to data from four stations on a previously examined transect in the same area. Seasonal peaks of density in the zooplankton and copepods generally occurred in the spring and fall, but seasonal and year to year variability was high. The dominant groups of zooplanktonic organisms included Copepoda, Larvacea, Mollusca, Euconchoecia, and Chaelognatha. Copepods generally comprised 50% to 65% of the zooplankton. Species diversity increased and density decreased with the distance from shore. GRA

N80-11755# National Marine Fisheries Service, Panama City, Fla. Panama City Lab.
ENVIRONMENTAL STUDIES OF THE SOUTH TEXAS CONTINENTAL SHELF. SNAPPER/GROUPER Final Report, 1977
William A. Fable, Jr. May 1979 32 p refs
(PB-296645/5; BLM/YM/ES-79/05) Avail: NTIS HC A03/MF A01 CSCL 08A

The tagging of 299 red snapper and 793 vermilion snappers is described. The nonmigratory behavior of the snappers is discussed and the effects of altering the snappers habitat is examined. A.W.H.

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-11756*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
***INDIRECT MICROBIAL DETECTION* Patent Application**
Judd R. Wilkins, inventor (to NASA) Filed 17 Aug. 1979 18 p
(NASA-Case-LAR-12520-1; US-Patent-Appl-SN-067596) Avail: NTIS HC A02/MF A01 CSCL 06C

The 'invention' disclosed is an indirect microbial detection method. The growth of microorganisms in a sample is detected and monitored by culturing microorganisms in a growth medium and detecting a change in potential between two electrodes separated from the microbial growth by a barrier which is permeable to charged particles but microorganism impermeable. NASA

N80-11757# Army Research Inst. of Environmental Medicine, Natick, Mass.
THE 5-THIO-D-GLUCOSE THERMOREGULATORY EFFECTS IN MICE AT VARIOUS TEMPERATURES
Ralph P. Francesconi and Milton Mager 14 May 1979 24 p refs
(AD-A069511; USARIEM-M-12/79) Avail: NTIS HC A02/MF A01 CSCL 06/5

Adult, male mice were administered various doses of 5-thio-D-glucose (5-TG) at three environmental temperatures: 4 C, 22 C, and 35 C. Both intracerebroventricular (ICV) and intraperitoneal (IP) administration of 5-TG resulted in significant (p less than .05 to p less than .001) decreases in rectal temperature (Tre) which were usually dose-dependent. After 30 min the hypothermic effects were significantly (p less than .001, ICV, 100 microgram) exacerbated by cold exposure (4 C vs 22 C) and were likewise intensified significantly (p less than .005, 45 min, fed vs 18 h fasted) by food deprivation. These decrements in rectal temperature (Tre) were accompanied by significant (p less than .001) increases in circulating levels of glucose. The present results indicate that 5 TG may be eliciting both central and peripheral cellular glucopenia concomitant with circulatory hyperglycemia; thus, the resultant hypothermia may be arising from competitive inhibition of glycolysis by 5 TG intermediates as well as reduced availability of tissue glucose. GRA

N80-11758# Medical Biological Lab. *RVO-TNO, Rijswijk* (Netherlands).
EARLY DIAGNOSIS OF DECOMPRESSION SICKNESS. CHANGES IN THE BLOOD FOUND SHORTLY AFTER DECOMPRESSION. EXPERIMENTS ON RATS
M. Wijnans, P. M. Draeck, and P. vanEck Jul. 1978 29 p refs In DUTCH; ENGLISH summary
(MBL-1978-7) Avail: NTIS HC A03/MF A01

In rats subjected to compression followed by decompression hemoconcentration was observed. The effects were then related to the severity of the applied compression-decompression procedure. In nearly all cases this hemoconcentration became apparent before signs of decompression-sickness were observed. Hemoconcentration occurred even in rats without symptoms. In a relatively large number of rats a drop in platelet count was noticed soon after decompression; but usually only after the platelet count was corrected for the hemoconcentration. It was found that in rats a rise in hematocrit had the highest prognostic value for the occurrence of symptoms of decompression sickness. Recommendations are given for an investigation of the possible prognostic value of hemoconcentration in divers. Author (ESA)

N80-11759# Deutsche Forschungs- and Versuchsanstalt fuer Luft- und Raumfahrt, Frankfurt am Main (West Germany). Inst. fuer Flugmedizin.
DISCRETE MULTIVARIATE ANALYSIS ON RADIOBIOLOGICAL RESULTS FROM THE BIOSTACK 3 BACILLUS SUBTILIS EXPERIMENT
R. Facius, H. Buecker, and M. Schaefer 1979 6 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May-Jun. 1979
Avail: NTIS HC A02/MF A01

The dependency of spore survival on HZE particle linear energy transfer (LET) and on their distance from the particles' trajectory during Biostack 3 experiments is discussed. Multivariate methods are applied as far as the stochastic point of view is concerned. It is shown that the major features of the bivariate results cannot be reduced to the heterogeneous frequency distributions of the respectively remaining physical parameters of the HZE particles. These findings bear on considerations about mechanisms, by which biological damage might be induced by high LET heavy ions. Author (ESA)

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-11760 Medical Univ. of South Carolina, Charleston.
CARBON DIOXIDE CONTRIBUTIONS IN RESPIRATORY CONTROL Ph.D. Thesis
Edwin Merrill Adams 1979 148 p
Avail: Univ. Microfilms Order No. 79620656

The contribution of carbon dioxide to respiratory control made by the carotid bodies and vagus nerves is investigated. The relationship between the central respiratory neutron in the ventral respiratory group and airflow, the latency response to CO2, the contribution of the carotid body to the hypercapnic response are discussed. Dissert. Abstr.

N80-11761# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).

IDENTIFICATION OF CONTROLS IN NEURO-MUSCULOSKELETAL CONTROL SYSTEM MODELS

H. Hatze Oct. 1978 25 p refs

(CSIR-TWISK-52) Avail: NTIS HC A02/MF A01

The commonly adopted practice of identifying the myo-actuator torques in neuro-musculoskeletal control systems as the system controls is discussed. It is demonstrated that it leads to biologically unrealistic results. A systems model describing the excitation and contraction dynamics of skeletal muscle is then presented. In this model the control parameters are the actual neural controls, motor unit recruitment and stimulation frequency, and the model correctly predicts experimentally observed muscular force outputs for a wide variety of neural control inputs. A general myocybernetic performance criterion, and certain special cases pertaining to specific contractive modes are also discussed. R.E.S.

N80-11762# Civil Aeromedical Inst., Oklahoma City, Okla.

INTERSTIMULUS INTERVAL AS IT AFFECTS TEMPORARY THRESHOLD SHIFT IN SERIAL PRESENTATIONS OF LOUD TONES

Jerry V. Tobias Jun. 1979 10 p refs

(AD-A072006; FAA-AM-79-16) Avail: NTIS HC A02/MF A01 CSCL 06/16

Temporary threshold shifts were measured repeatedly during a session in order to determine effects of interstimulus interval (ISI) on the shift. The fatiguing sound was a 3 minute, 110 dB SPL, 4,000 Hz tone. Immediately following the 3 minute stimulation, Bekesy-audiometric tracings were made for 3 minutes at 5,656 Hz. Then the subject sat quietly for the ISI that was used during that session. The effect of the subject's rest time or time off was compared at two points on the recovery curve: at 30 seconds and at 2 minutes following the cessation of the fatiguing sound. For susceptible subjects tested with short-duration ISIs, each successive threshold showed a greater shift than the earlier ones for at least four tests. As ISI was increased, improvement seemed not to follow the expected linear form. At some critical value that varies from subject to subject, successive tests no longer differ from each other; each one is similar to a first trial in which no previous exposure to the high-level tone has occurred. For most subjects run under these conditions, the critical ISI value is at least 30 minutes. Author

N80-11763*# Boeing Aerospace Co., Houston, Tex.

STARPAHC SPACE-ORIENTED MEDICAL EVALUATION Final Report

12 Oct. 1979 6 p refs

(Contract NAS9-14513)

(NASA-CR-160360) Avail: NTIS HC A02/MF A01 CSCL 06E

Development of the STARPAHC telemedicine system is documented. Using STARPAHC assessment results and monitoring experience, on board and ground based flight medical system monitoring requirements and operational procedures were developed for use with the Space Transportation System during OFT and mature operation phases of the shuttle. K.L.

N80-11764# Army Research Inst. of Environmental Medicine, Natick, Mass.

HYPOTHERMIA INDUCED BY CHLORPROMAZINE OR L-TRYPTOPHAN EFFECTS ON TREADMILL PERFORMANCE IN THE HEAT

Ralph P. Francesconi and Milton Mager 28 Mar. 1979 21 p refs

(DA Proj. 3E1-61102-8S-08)

(AD-A069849; USARIEM-M-8/79) Avail: NTIS HC A02/MF A01 CSCL 06/19

To study the effects of preinduced hypothermia on the physiological and thermoregulatory responses to exercise in the heat, rats were intravenously administered 100 microgram of chlorpromazine (Cpz) or 200 mg/kg of L-tryptophan (L-tryp) under restraint in a cold (4 C) environment. When rectal temperatures (Tre) reached 32-33 C, the rats were removed to a hot environment (35 C) where they ran on a level treadmill (9.14 m/min) to hyperthermic exhaustion (Tr - 42.5-43 C). Both Cpz and L-tryp hypothermia was effective in increasing significantly (p less than .001) the time to hyperthermic exhaustion. However, the maximal tre and skin temperatures (Tsk) attained were unaffected by either treatment. While exercising on the treadmill increments (C/min) in Tre and Tsk were significantly (p less than .02, minimal) greater for the initially hypothermic animals when compared to normothermic controls. Cooling rates were unaffected by either treatment. We concluded from these studies that while preinduced hypothermia is extremely effective in prolonging the time to hyperthermic exhaustion, no additional beneficial thermoregulatory responses accrued as a result of this treatment. Author (GRA)

N80-11765# Army Research Inst. of Environmental Medicine, Natick, Mass.

COLD AIR INHALATION, ESOPHAGEAL TEMPERATURE LUNG FUNCTION IN EXERCISING HUMANS Final Report

J. J. Jaeger, E. Chandler Deal, Jr., D. E. Roberts, and E. R. McFadden, Jr. 14 Mar. 1979 24 p refs Prepared in cooperation with Peter Bent Brigham Hospital, Boston, Mass. and Harvard Medical School, Boston, Mass.

(AD-A069510; USARIEM-M-7/79) Avail: NTIS HC A02/MF A01 CSCL 06/16

Eight normal individuals performed 10 min of bicycle exercise at 80% of their predicted maximum workload while breathing air at 22 C, saturated with water vapor and air at -40 C, dry. Rectal temperature and temperature at various locations along the length of the esophagus were measured during the exercise period. Pulmonary mechanics were measured before and 5 to 10 min after exercise. Temperature in the lower third of the esophagus was in close agreement with rectal temperature and was unaffected by level of respiratory heat exchange. Upper esophageal temperature decreased substantially during exercise, the magnitude of the decrease being dependent upon proximity to intrathoracic airways and the level of respiratory heat exchange. Subjects bronchodilated in response to exercise breathing warm air but this response was abolished by exercise breathing -40 C air. We conclude that at sufficiently high levels of respiratory heat exchange, normal individuals exhibit mild bronchoconstriction qualitatively similar to the severe bronchospasm induced in asthmatics by modest increases in respiratory heat exchange. GRA

N80-11766# Army Aeromedical Research Lab., Fort Rucker, Ala.

A PORCINE BIOASSAY METHOD FOR ANALYSIS OF THERMALLY PROTECTIVE FABRICS: A CLINICAL GRADING SYSTEM Final Report

Thomas L. Wachtel, Francis S. Knox, III, and G. R. McCahan, Jr. Jun. 1978 35 p refs

(DA Proj. 3E7-62173-A-819)

(AD-A069202; USAARL-78-8) Avail: NTIS HC A03/MF A01 CSCL 06/3

A clinical grading system of severity of cutaneous burn was developed in a porcine cutaneous burn bioassay model using a flame thermal source. From surface appearance, color, sensation, tactile response, tenacity of hair anchoring, and appearance on cut section, a progression of the severity of burn injury was developed and documented with serial still photographs, high-speed cinephotomacrography and clinical descriptions. Variations in this grading scheme were required for skin protected or partially protected with fabrics, blackened with stove polish, or deprived of its circulation. GRA

N80-11767# Gesamthochschule, Siegen (West Germany). Dept. of Physics.

CALCULATED LINEAR ENERGY TRANSFER SPECTRA OF HZE PARTICLES FOR THE FREE FLYER BIOSTACK EXPERIMENT ON THE LDEF-MISSION

W. Heinrich 1979 14 p refs

Avail: NTIS HC A02/MF A01

The LDEF-mission, scheduled for launch on the Space Shuttle in 1981, will fly for about nine months in a near earth orbit

with an inclination angle of 28. During this flight the Free Flyer Biostack experiment will measure biological effects of individual heavy ions from cosmic radiation. The corresponding results of a calculation of linear energy transfer (LET) spectra in free space and inside the experiment are presented. The calculation considers the geomagnetic shielding of the spacecraft against charged particles with low energies and the disintegration of the heavy ions inside the experiment by fragmentation. For this mission the LET spectra will differ significantly from those of previous experiments. Primary particles with high LET are scarce. Inside the experiment the LET spectra change with depth of matter due to the energy loss and fragmentation of the nuclei.
Author (ESA)

N80-11768# Deutsche Forschungs- and Versuchsanstalt fuer Luft- und Raumfahrt, Frankfurt am Main (West Germany). Inst. fuer Flugmedizin.
SUMMARY OF RADIOBIOLOGICAL FINDINGS: FROM SPACEFLIGHT TO GROUND-BASED STUDIES ***Annual Report***
H. Buecker and R. Facius 1979 8 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979
Avail: NTIS HC A02/MF A01

Radiobiological studies relative to manned space flight are reviewed. The prediction of relevant physical parameters, radiation effects and space flight factors, late effects, and heavy effects are discussed. It is concluded that a priori assessment of the radiobiological risk from longer duration space missions remains as yet a difficult task. The fact that some symptoms of biological injury become manifest only long after exposure is pointed out. Author (ESA)

N80-11769# National Technical Information Service, Springfield, Va.
TELECOMMUNICATIONS IN MEDICINE. A BIBLIOGRAPHY WITH ABSTRACTS ***Progress Report, 1964 - Jul. 1979***
Elizabeth A. Harrison Aug. 1979 150 p Supersedes NTIS/PS-77/0725; NTIS/PS-76/0641; NTIS/PS-75/580; NTIS/PS-78/0751
(NTIS/PS-79/0786/8; NTIS/PS-78/0751; NTIS/PS-77/0725; NTIS/PS-76/0641; NTIS/PS-75/580) Avail: NTIS HC $28.00/MF $28.00 CSCL 06E

Research reports cover teleconsultation, communications for emergency medical services, medical communication networks and television systems, and telecommunications for medical information systems and rural health services. This updated bibliography contains 143 abstracts, 15 of which are new entries to the previous edition. GRA

N80-11770# New Mexico Univ., Albuquerque. Technology Application Center.
ALTITUDE ACCLIMATIZATION. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE ***Progress Report, 1974 - Jul. 1979***
Samuel C. Mauk Aug. 1979 31 p Sponsored in part by NTIS
(NTIS/PS-79/0857/7) Avail: NTIS HC $28.00/MF $28.00 CSCL 06P

This bibliography the international literature and covers all aspects of altitude acclimatization. Topics include high altitude environments, hypoxia, heart function and hemodynamic responses, physical exercise, human tolerances and reactions, physiological responses, and oxygen consumption. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-11771*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
PERFORMANCE, PHYSIOLOGICAL, AND OCULOMETER EVALUATION OF VTOL LANDING DISPLAYS ***Final Report***
R. A. North, S. P. Stackhouse, and K. Graffunder NASA Sep. 1979 160 p refs
(Contract NAS1-15081)
(NASA-CR-3171; HONEYWELL-F0584-FR1-1) Avail: NTIS HC A08/MF A01 CSCL 05H

A methodological approach to measuring workload was investigated for evaluation of new concepts in VTOL aircraft displays. Physiological, visual response, and conventional flight performance measures were recorded for landing approaches performed in the NASA Visual Motion Simulator (VMS). Three displays (two computer graphic and a conventional flight director), three crosswind amplitudes, and two motion base conditions (fixed vs. moving base) were tested in a factorial design. Multivariate discriminant functions were formed from flight performance and/or visual response variables. The flight performance variable discriminant showed maximum differentiation between crosswind conditions. The visual response measure discriminant maximized differences between fixed vs. motion base conditions and experimental displays. Physiological variables were used to attempt to predict the discriminant function values for each subject/condition trial. The weights of the physiological variables in these equations showed agreement with previous studies. High muscle tension, light but irregular breathing patterns, and higher heart rate with low amplitude all produced higher scores on this scale and thus represent higher workload levels.
Author

N80-11772# Oklahoma Univ., Norman. Coll. of Education.
COGNITIVE STYLES: A REVIEW OF THE LITERATURE ***Interim Report, Jan. 1977 - Jan. 1978***
Tillman J. Ragan, Kathryn T. Back, Vance Stansell, Lynna J. Ausburn, Floyd B. Ausburn, Patricia A. Butler, and Keith Huckabay Brooks Air Force Base, Tx. Air Force Human Resources Lab., Brooks Air Force Base, Tx. May 1979 62 p refs
(Contract F33615-77-C-0047; AF Proj. 2313)
(AD-A069435; AFHRL-TR-78-90(I)) Avail: NTIS HC A04/MF A01 CSCL 05/9

A review of the literature to identify the various cognitive style constructs and the instruments used to measure them was completed. Each was evaluated with specific attention to possible relationships to Air Force technical training. Ten cognitive styles were selected for an in-depth summary of the state of the art, with special attention given to those that gave most promise for use. GRA

N80-11773# California Univ., Berkeley. Operations Research Center.
THE SCOPE, LIMITS, AND TRAINING IMPLICATIONS OF THREE MODELS OF AIRCRAFT PILOT EMERGENCY RESPONSE BEHAVIOR ***Research Report***
Stuart E. Dreyfus and Hubert L. Dreyfus Feb. 1979 39 p refs
(Grant AF-AFOSR-3594-78; AF Proj. 2313)
(AD-A071320; ORC-79-2) Avail: NTIS HC A03/MF A01 CSCL 05/9

Three models of skill acquisition are proposed: (1) Nonsituational, (2) Intermediate, and (3) Situational. It is argued that only the third can account for highly skilled performance. The type of emergency training program each suggests and the level of pilot performance that each can be expected to produce is then investigated. We conclude that only training based on the situational model could possibly produce highly skilled emergency response behavior. GRA

N80-11774# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
ROTARY WING PROFICIENCY-BASED AVIATOR SELECTION SYSTEM (PASS) ***Final Report, 15 Feb. 1977 - 1 Mar. 1978***
Ruth Ann Marco, Richard F. Bull, Ronald L. Vidmar, and Brian D. Shipley, Jr. Jan. 1979 244 p refs
(Contract DAHC19-77-C-0015; DA Proj. 2Q2-63743-A-722)
(AD-A069838; MDC-1839; ARI-TR-79-A2) Avail: NTIS HC A11/MF A01 CSCL 05/9

The Proficiency-Based Aviator Selection System (PASS) is the result of an operational feasibility program developed to determine whether a learning sample approach could be used to select candidates for rotary wing aviator training. PASS was based on the Automatic Pilot Aptitude Measurement System (APAMS), a five-hour learning sample of fixed wing piloting

tasks, developed for the Air Force Pilot Selection Program. PASS utilizes a UH-1 Flight Simulator (UH-1 FS) with a five-degree-of-freedom motion base to present the syllabus and test materials. the APAMS syllabus was extensively modified to conform to rotary wing flight operations, and the UH-1 FS software was reconfigured and formatted to meet the PASS requirements for training and performance measurement. Four voice synthesizers (VOTRAX) were interfaced to the UH-1 FS to provide vocal feedback. The operational capability of the PASS was demonstrated in a test with 11 experienced rotary wing pilots and 11 candidates for rotary wing training. The primary audience for this report will be operational personnel in training selection and simulation, particularly for rotary wing aircraft. GRA

N80-11775# Washington Univ., Seattle. Dept. of Psychology.

INTELLIGENCE AS AN INFORMATION PROCESSING CONCEPT Interim Report, 1 Apr. 1978 - 31 Mar. 1979

Earl Hunt May 1979 91 p refs Presented at the Brit. Psychological Soc. Conf. Nottingham, Engl. Apr. 1979 (Contract N00014-77-C-0225; NR Proj. 154-398; RR04206O1)

(AD-A069953) Avail: NTIS HC A05/MF A01 CSCL 05/10

This paper examines the relationship between general cognitive competence and several aspects of information processing. Three sources of individual differences in information processing are proposed: structure, strategy, and general attentional resources. Structural factors set limits on the effectiveness of specific information processing steps. These factors appear to be important when we contrast the cognitive capacities of extreme groups, such as normal and mentally retarded persons but they account for only a small amount of the variability in homogeneous groups such as college students. The reason may be that within such groups, strategy of attacking problems is a more important source of variation, and moderates the relationship between simple information processing steps and complex reasoning. Finally, the fact that scores on almost all measures of cognitive competence are positively correlated may be related to the fact that all mental processes seem to compete for general attentional resources, and that individuals differ in the attentional resources they can bring to bear on any cognitive task. Author (GRA)

N80-11776# Canyon Research Group, Inc., Westlake Village, Calif.

DEVELOPMENT OF UNIT TRAINING AND EVALUATION TECHNIQUES FOR COMBAT-READY HELICOPTER PILOTS. TASK 2: ASSESSMENT OF ARTEP AND ATM TRAINING OBJECTIVES AND REQUIREMENTS FOR MAINTAINING OPERATIONAL READINESS Research Note, 21 Sep. 1977 - 20 Sep. 1978

Colin D. Ciley, Jr. and George E. Long May 1979 25 p refs (Contract DAHC19-77-C-0059)

(AD-A069224; FTR-01-78; ARI-RN-79-11) Avail: NTIS HC A02/MF A01 CSCL 05/9

The recently published Army Training and Evaluation Programs (ARTEP) and Aircrew Training Manuals (ATM) represent a new concept of Army aviation unit training. Commanders are now responsible for determining the training requirements of their individual units and for developing and implementing programs to meet those requirements. The ARTEP and ATMs were designed to assist the unit commanders in carrying out that responsibility. This report presents the results of a brief review of the utility of these documents in the field and the extent to which their content adequately represents the training objectives and requirements for maintaining combat readiness. The research concludes that the documents have been well received and are being utilized effectively by field commanders; that they contain a valid, though not entirely complete, reflection of combat-readiness training objectives and requirements; but, that the required recordkeeping is burdensome and there is a need for a more effective feedback system between its users and its developers. Author (GRA)

N80-11777# Canyon Research Group, Inc., Westlake Village, Calif.

DEVELOPMENT OF UNIT TRAINING AND EVALUATION TECHNIQUES FOR COMBAT-READY HELICOPTER PILOTS. TASK 1: DEVELOPMENT OF AN INSTRUCTION PROGRAM FOR INDIVIDUAL AND UNIT TRAINING WITH COMBAT-READY PILOTS Research Note, 21 Sep. 1977 - 20 Sep. 1978

George E. Long, Colin D. Ciley, Jr., Roik L. Jockenberger, and Ethlyn A. Garlich May 1979 86 p refs (Contract DAHC19-77-C-0059; DA Proj. 2Q2-63743-A-772) (AD-A069242; FTR-05-78-1; ARI-RN-79-10-1) Avail: NTIS HC A05/MF A01 CSCL 05/9

The attainment and maintenance of combat readiness must be a, if not the, primary responsibility of every field unit commander. To carry out that responsibility, commanders of units with combat missions need training and evaluation techniques that will train pilots who already know how to fly to accomplish the requirements of a specific mission in a battlefield environment as part of the combined arms team. In order to provide the required techniques and procedures noted above, it is first necessary to derive an effective and efficient approach to their development. That approach should result in the availability of techniques and procedures that will facilitate the attainment of the highest level of combat readiness in the largest number of operational units in the shortest amount of time. This report describes the research effort directed at the derivation of an approach to the development of training and evaluation techniques and procedures for combat-readiness training that will meet the above noted requirements. It also describes the effort directed at the partial development of two training modules consistent with that approach. Author (GRA)

N80-11778# Illinois Univ. at Urbana-Champaign. Engineering-Psychology Lab.

HUMAN FAILURE DETECTION AND RESOURCE ALLOCATION IN DYNAMIC ENVIRONMENT Final Report, 1 Jul. 1977 - 31 Dec. 1978

Christopher D. Wickens Feb. 1979 31 p ref (Contract AF-AFOSR-3380-77; AF Proj. 2313) (AD-A069821; EPL-79-2; AFOSR-79-0682TR) Avail: NTIS HC A03/ MF A01 CSCL 05/10

Three major areas of research are summarized. (1) Processing Resource allocation between tasks in dynamic environments. Results indicate that these abilities are distinctly limited. Rather than effectively allocating in response to task demand increases, the operator appears to temporarily 'expand' the capability of available processing resources. (2) Failure detection in dynamic systems. Human operators are found to be better at detecting failures (step transitions n the order of a dynamic system) when they are active participants in controlling those systems, than when they are passive monitors of the system under autopilot control. Some reasons for this difference are discussed, while research explores the role of training, and information processing channels in the detection process. (3) The attentional demands of failure detection. A model of human processing resources is described which partitions these resources into structure-specific reservoirs related to stages of processing. Task interference patterns between failure detection in the controlling vs. the autopilot monitoring mode, and between two qualitatively different loading tasks are shown to be consistent with this structure-specific resource view. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-11779# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.

LINEAR STATE FEEDBACK CONTROL OF RIGID-LINK MANIPULATORS

David F. Golla May 1979 66 p refs (UTIAS-TN-214; ISSN-0082-5263) Avail: NTIS HC A04/MF A01

Linear state variable feedback controllers were designed for rigid-link manipulator arms. Two types of feedback schemes were considered, general rigid control (GRC) which allows for both interjoint and intrajoint feedback, and independent joint control

(IJC) which allows for only intrajoint feedback. The design scheme consisted of arbitrary closed loop pole placement. Pole assignment algorithms were developed for both GRC and IJC feedback control schemes. Two controllers, IJC and GRC, were designed for a preliminary two-link rigid model of the space shuttle manipulator arm carrying a full payload in planar motion. The two models are simulated and the controllers compared. R.E.S.

N80-11780# Virginia Polytechnic Inst. and State Univ., Blacksburg.

SPATIO-TEMPORAL INTERGRATION IN THE VISUAL SYSTEM Final Technical Report, Aug. 1975 - Dec. 1977

Maier Algamor, Willard W. Farley, and Harry L. Snyder Feb. 1979 104 p refs

(Contract F33615-76-C-5022; AF Proj. 7184)

(AD-A069558; VPI-HFL-78-6; AMRL-TR-78-126) Avail: NTIS HC A06/MF A01 CSCL 05/10

A new model for temporal and spatial encoding in the visual system is developed and presented. Three series of experiments were conducted to validate the model. The experiments used (1) a TV display of random, dynamic noise, and (2) a specially designed stimulus generator which produces very large homogeneous visual fields which can be easily modulated to reproduce a large variety of temporal waveforms having a rise time longer than 1 ms. The obtained results support the proposed model. The principal findings are: (1) Time integration of the eye is locally controlled at the retina and has very fast dynamics. (2) The obtained CFF curves suggest a correlation between the frequency at which maximum sensitivity is obtained and the sensitivity itself. (3) As predicted by the model, temporal bands are developed in the visual system for stimuli showing temporal discontinuity points. The width of the temporal bands was measured and a strong correlation was found between the temporal band width and the integration time. The width of the temporal bands is a function of the luminance level of the bands; the width is not dependent on the stimulus slope. The apparent brightness of the temporal band is, however, dependent on the slope of the stimulus. GRA

N80-11781# Anthropology Research Project, Yellow Springs, Ohio.

HEIGHT/WEIGHT SIZING PROGRAMS FOR WOMEN'S PROTECTIVE GARMENTS

Ilse Tebbetts, John T. McConville, and Milton Alexander Jun. 1979 126 p refs

(Contract F33615-79-C-0511; AF Proj. 7184)

(AD-A072376; AMRL-TR-79-35) Avail: NTIS HC A07/MF A01 CSCL 06/17

Presented in this report is a series of height/weight sizing programs for use by designers of protective clothing for USAF women. The sizing values are based on an analysis of data obtained in the 1968 survey of Air Force women and cover some 60 dimensions (excluding head, hand and foot measurements). Author (GRA)

N80-11782# Honeywell Systems and Research Center, Minneapolis, Minn. Government and Aeronautical Products Div.

INTEGRATED HELMET-MOUNTED SIGHT/DISPLAY PROGRAM: COATING TECHNOLOGY Technical Report, 15 May 1973 - 15 Jun. 1973

J. M. Seeman and L. E. Homstad Jul. 1979 169 p refs

(Contract F33615-72-C-0420; AF Proj. 5973)

(AD-A072060; HONEYWELL-2079-SR3; AMRL-TR-79-61) Avail: NTIS HC A08/MF A01 CSCL 05/8

Contents: Introduction; Summary of task results--Optics on plastics, Variable density, Durability and Abrasions, High absorption; Conclusions; Recommendations; Discussion; and References. GRA

N80-11783# Honeywell Systems and Research Center, Minneapolis, Minn.

HELMET-MOUNTED DISPLAYS: AN EXPERIMENTAL INVESTIGATION OF DISPLAY LUMINANCE AND CONTRAST

B. J. Cohen, J. R. Bloomfield, and K. J. McAleese Jul. 1979 73 p refs

(Contract F33615-72-C-0420)

(AD-A072059; AMRL-TR-79-60) Avail: NTIS HC A04/MF A01 CSCL 14/2

This study was carried out in order to validate experimentally the predictions of previous analytic work (Cohen, 1973). The objective was to determine the best combination of filter coatings and display luminances required for viewing the Helmet Mounted Display (HMD) against a wide, but operationally realistic variety of background luminances. The predictions relating beamsplitter transmittance, visor transmittance and display luminance to performance were largely supported by the data. GRA

N80-11784# Honeywell Systems and Research Center, Minneapolis, Minn.

HELMET-MOUNTED DISPLAYS: A COMPUTER-ASSISTED ANALYSIS OF DAY-NIGHT VISUAL REQUIREMENTS

B. J. Cohen Jul. 1979 296 p refs

(Contract F33615-72-C-0420; AF Proj. 5973)

(AD-A072061; HONEYWELL-2079-SR5; AMRL-TR-79-62) Avail: NTIS HC A13/MF A01 CSCL 14/2

Honeywell has conducted a computer-assisted analysis in order to predict the range of ambient luminance conditions under which Helmet Mounted Display (HMD) imagery can be usefully resolved by an observer. This report examines those variables relating to ambient luminance, display luminance, and the attenuation of each in terms of optimizing display contrast minimizing differences in luminance to the two eyes. Visual performance predictions were made based upon comparing the analytically derived data with criteria values obtained from a limited number of technical reports. These criteria values were used even though it was recognized that the monocular see-through HMD is a unique system, thus limiting the applicability of data obtained from studies of related but still dissimilar systems such as head-up displays (HUDs) and occluded monocular HMDs. Among the factors affecting the quality of the displayed imagery, those variables most crucial to display luminance and contrast were systematically varied on a computer. GRA

N80-11785# Honeywell Systems and Research Center, Minneapolis, Minn. Systems and Research Center.

THE ROLE OF THE UPPER FIELD OF VIEW IN SELECTED HMS/D VISUAL TASKS

B. J. Cohen and R. A. Levit 12 Jul. 1979 38 p refs

(Contract F33615-72-C-0420; AF Proj. 5973)

(AD-A072064; F4001-HSR1; AMRL-TR-79-65) Avail: NTIS HC A03/MF A01 CSCL 05/8

A study was conducted to determine whether opaque obstructions located in an observer's upper field of view would affect the visual detection of briefly illuminated targets located above his horizontal line of sight. Five versions of an acrylic visor considered for use with a helmet-mounted sight and display (HMS/D) contained one or more opaque areas located above their horizontal axes. Target detection performance for 12 subjects using the experimental visors was compared with the subjects' performance using an unobstructed control visor. Target appearance was signalled by a central cue light for six subjects (directed search), while the other six subjects were forced to rely only on peripheral detection of the briefly illuminated targets (undirected search). It was found that target detection performance was unaffected by either visor obstructions or by method of search, or any combination of the two. It was concluded that any of the visors would be usable from a visual performance standpoint. GRA

N80-11786# Honeywell Systems and Research Center, Minneapolis, Minn.

HELMET-MOUNTED SIGHT/DISPLAY PROGRAM: CESSNA 310 FLIGHT TEST

L. J. Mueller and B. A. Olson 12 Jul. 1979 84 p refs

(Contract F33615-72-C-0420)

(AD-A072058; F5517-HSR2; AMRL-TR-79-59) Avail: NTIS HC A05/MF A01 CSCL 05/8

The first phase of an engineering flight evaluation of operator performance with a Helmet-Mounted Sight/Display system has been completed. A total of 22 flights were conducted during which subjects utilized a helmet-mounted sight to control the pointing direction of a gimballed television camera and a helmet-mounted display to view the picture from the TV camera. Particular attention was paid to any indication of disorientation

or discomfort attributable to the helmet-mounted equipment. No significant effect was noted. Secondary investigations considered the effect of servo dynamics in the TV camera system, angular motion limits in the pointing system, display field for view, display brightness, and environmental factors including target complexity and contrast, ambient brightness, and atmospheric haze. Interaction between the ambient scene viewed directly and through the combining glass of the helmet display caused no difficulty during the experiment. A second phase of this study considered the potential for inducing vertigo through the use of helmet-mounted equipment. The test plan and preliminary results for this experiment are presented in an appendix to this report. A detailed report on Phase II will be issued later. GRA

N80-11787# Honeywell Systems and Research Center, Minneapolis, Minn.
OPERATIONAL PILOT FACTORS ANALYSIS REPORT
B. A. Olson 12 Jul. 1979 123 p refs
(Contract F33615-72-C-0420; AF Proj. 5973)
(AD-A072063; HONEYWELL-2079-SR7; AMRL-TR-79-64)
Avail: NTIS HC A06/MF A01 CSCL 14/2

This report describes the studies and analysis work done to identify performance requirements with respect to the operator who will wear the helmet and use the helmet sight/display system in the operational situation. Its purpose is to identify and document performance requirements for the IHMS/D equipment with respect to: Pilot population anthropometric and visual characteristics. Environmental effects of ambient light, field of view, acceleration, vibration, noise and space available. Display information requirements of accuracy, format, brightness, contrast, and the control response of the system. Author (GRA)

N80-11788# Army Aeromedical Research Lab., Fort Rucker, Ala.
HEAD AIMING/TRACKING ACCURACY IN A HELICOPTER ENVIRONMENT Final Report
Robert W. Verona, John C. Johnson, and Heber D. Jones May 1979 86 p
(AD-A071359; USAARL-79-9) Avail: NTIS HC A05/MF A01 CSCL 05/8

This experiment was conducted to measure man's head aiming/tracking capability using a helmet mounted sighting device. The influences of target speed, helmet suspension types, and helmet weighting parameters on head aiming/tracking were investigated. If the aiming/tracking accuracy was sensitive to manipulation of these man-machine interface parameters, then it would seem to indicate that improved aiming/tracking accuracy could be obtained by improving the interface. The factors analyzed were eye dominance, helmet weighting, target speed, and helmet suspension. The eye dominance, helmet weighting, and target speed factors were statistically significant; however, the only factor of practical significance was target speed. A subject aiming at a static target with his head had an RMS error of about 3 milliradians. When the target began to move 4 degrees/second, the error increased to about 10.5 milliradians. When the subject began to vibrate, too, the error increased to 13 milliradians. When the target speed doubled, the vibrating error increased to 16.8 milliradians. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-11789# Naval Air Development Center, Warminster, Pa. Communication Navigation Technology Directorate.
BASIC LABORATORY ARCHITECTURE PLAN Final Report
Stanley Greenberg, Carl Joeckel, and Richard Mejzak 17 May 1979 302 p
(AD-A072427; NADC-79161-40) Avail: NTIS HC A14/MF A01 CSCL 05/2

Provided herein is a definition of an avionic information processing system architecture and recommendations for implementing a subset of this architecture in the BASIC (Basic Avionic Subsystem Integration Concept) Laboratory. This recommended architecture is classified as a distributed, multiple processing system. It was derived based on the S-3A operational requirements employing a structured system design methodology. The AYK-14 airborne computer and 1553 bus were utilized to the greatest possible extent. A structured system design methodology was employed as a tool in arriving at the architecture in this report. GRA

N80-11790# SRI International Corp., Menlo Park, Calif.
STUDY OF AUTOMATED COMMAND SUPPORT SYSTEMS Final Report, 1 Apr. 1978 - 30 Mar. 1979
Marshall C. Pease and Daniel Sagalowicz 9 Jul. 1979 56 p refs
(Contract N00014-77-C-0308)
(AD-A072298) Avail: NTIS HC A04/MF A01 CSCL 09/2

This study addresses techniques for the design of automated support systems for naval management. It seeks to apply advanced computer techniques developed by the artificial intelligence community to real-world command environments. The managerial environment exhibits two major differences from most other application environments. First, the problems encountered by the manager are not routine or predictable. It is important that it be possible to tune the system to the actual needs as the problem develops. Second, the manager is the expert; he must be able to understand the system's behavior and the reasons for the actions it takes. In combination, these requirements indicate that the commander, or his delegate, should be able to modify or extend the system even though they may have little knowledge of programming or system design. The crucial design issue is to provide means by which the human user can exercise deep control without requiring a correspondingly deep knowledge of the system's implementation. The primary device we have exploited to provide the user with effective control is to base the design on the explicit encoding of the system's knowledge as a set of models each of which contains the constraints and goals that describe necessary relations in the information that describes the situation in a specified component of the application environment. These models remain available to the user for his study and modification. The implementation principles used to develop this design have been demonstrated in an experimental system called ACS.1 for automated command support. GRA

N80-11791# Naval Research Lab., Washington, D. C.
A USERS GUIDE FOR THE ADVANCED SCIENTIFIC COMPUTER (ASC) Interim Report

Walter W. Jones 26 Jun. 1979 44 p
(RR040941)
(AD-A072405; NRL-MR-3979) Avail: NTIS HC A03/MF A01 CSCL 09/2

A great deal of effort goes into starting on a new computer system. This is especially true on sophisticated system designed to accomplish intricate tasks. In order to minimize this effort and thus to maximize people usefulness this guide has been prepared for the NRL ASC computer. GRA

N80-11792# University of Southern California, Marina del Rey. Information Sciences Inst.

AN EXPERIMENT IN DISTRIBUTED INTERPRETATION

Victor R. Lesser (Mass. Univ.) and Lee D. Erman May 1979 52 p refs Prepared jointly with Mass. Univ., Amherst, and Carnegie-Mellon Univ., Pittsburgh
(Contracts DAHC15-72-C-0308; F44620-73-C-0074; Grant NSF MCS-78-04212; ARPA Order 2223)
(AD-A072558; ISI/RR-79-76; CMU-CS-79-120) Avail: NTIS HC A04/MF A01 CSCL 09/2

The range of application areas to which distributed processing has been applied is limited. In order to extend this range, new models for organizing distributed systems must be developed. We present a new model, in which the distributed system is able to function effectively even though processing nodes have inconsistent and incomplete views of the data bases necessary for their computations. This model differs from conventional approaches in its emphasis on dealing with distribution-caused uncertainty and errors in control, data, and algorithm as an integral part of the network problem-solving process. We show how this new model can be applied to the problem of distributed interpretation. Experimental results with an actual interpretation system support these ideas. GRA

N80-11793# Texas A&M Univ., College Station. Dept. of Electrical Engineering.

A COMPARISON OF LOW-COST MICROPROCESSORS FOR THE GPS RECEIVER PROCESSOR Final Report

Phillip S. Noe Sep. 1978 10 p
(Grant AF-AFOSR-3377-77; AF Proj. 2304)
(AD-A072632; TAMU-DSL-RM-78-03; AFOSR-78-1447TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report compares the floating point capabilities of the LSI-11 Motorola 6800, and projects the capabilities of three recently announced 16 bit processors, the Intel 8086, the Zilog Z8000, and the Motorola 68000. GRA

N80-11794# Sandia Labs., Albuquerque, N. Mex.

TOWARD AUTOMATING THE DATABASE DESIGN PROCESS

P. L. Asprey 25 Apr. 1979 20 p refs Presented at 20th AESOP Conf., Gatlinburg, Tenn, 24 Apr. 1979
(Contract DE-AC04-76DP-00789)
(SAND-79-0858C; Conf-790431-3) Avail: NTIS HC A02/MF A01

An approach to designing complex, interrelated databases is described. The problems encountered and the techniques developed are discussed. A set of software tools to aid the designer and to produce an initial data base directly is presented. DOE

N80-11795# Ohio State Univ., Columbus.

WHAT WILL YOUR TIME SERIES ANALYSIS COMPUTER PACKAGE DO? COMPUTER PACKAGES

D. J. Pack 1978 35 p refs Presented at the IMS Special Topics Meeting on Time Series Analysis, Ames, Iowa, 1 May 1978
(Contract W-7405-eng-26)
(CONF-7805149-2) Avail: NTIS HC A03/MF A01

Packages relating to the ARIMA model building process and packages that are nonspectral are presented. The survey is segmented into general purpose standard statistical packages (BMDP, IMSL, SAS, SPSS), many method packages, and integrated ARIMA model building packages. Likely new directions are discussed. A number of concerns arise as a result of the survey, relating to the absence of time series capabilities in the standard statistical packages, the definition of an optimal method, the supply of computer packages from the academic to the business environment, and the degree of computerization appropriate for time series analysis. DOE

N80-11796# Idaho National Engineering Lab., Idaho Falls. Electrical Design Branch.

INFLUENCE OF MICROPROCESSOR TECHNOLOGY ON INSTRUMENT AND SYSTEM DESIGN

M. Ray Johnson 1979 18 p Presented at 8th IMEKO Congr., Moscow, 21 May 1979
(Contract EY-76-C-07-1570)
(CONF-790525-1) Avail: NTIS HC A02/MF A01

Current microprocessor technology as it relates to the design of instruments and instrumentation and control systems is surveyed. Representative applications of microprocessors are examined, including some implemented at the Idaho National Engineering Laboratory. Trends in LSI product capability, programming languages, standardization, and applications such as intelligent transducers and distributed processing systems are considered. DOE

N80-11797# Oak Ridge Y-12 Plant, Tenn.

MICROCOMPUTER-BASED VIDEO MOTION DETECTION SYSTEM

L. C. Howington 1979 8 p Presented at the Carnahan Conf. on Crime Countermeasures, Lexington, Ky., 16-18 May 1979
(Contract W-7405-eng-26)
(Y/DA-7999; Conf-790502-4) Avail: NTIS HC A02/MF A01

This system was developed to enhance the volumetric intrusion detection capability of the Oak Ridge Y-12 Plant's security program. Not only does the system exhibit an extended range of detection over present infrared, microwave, and ultrasonic devices, it also provides an instantaneous assessment capability by providing the operator with a closed-circuit television (CCTV) image of the alarm scene as soon as motion is detected. The system consists of a custom-built, microcomputer-based, video processor which analyzes the signals received from a network of video cameras. The operator can view the camera images as they are displayed on a CCTV monitor while alarm scenes are displayed on a second monitor. Motion is detected by digitizing and comparing successive video frames and making an alarm decision based on the degree of mismatch. DOE

N80-11798# Brookhaven National Lab., Upton, N. Y.

BLACKOUTS AND BROWNOUTS AND THEIR EFFECT ON COMPUTER OPERATIONS

A. Peskin and C. Pittenger Sep. 1978 11 p refs Presented at the AESOP-SCIE Symp. on Advan. Computing, Las Vegas, Nev., 19 Oct. 1978
(Contract EY-76-C-02-0016)
(BNL-24960; Conf-781061-3) Avail: NTIS HC A02/MF A01

Reasons for blackout and brownouts and the sensitivity of computers to them are described. The sequence of events in one typical blackout is recalled. The effects of blackouts on computers are discussed. It is estimated that the total cost of blackouts at a busy installation could exceed several hundred thousand dollars a year. An uninterruptible power system (UPS) can provide temporary power when utility power is unavailable. A solid-state UPS typically has four sections: battery, inverter, rectifier/charger, and UPS bypass. The computer must experience a minimum disturbance of voltage wave forms and phase relationships during switching. Considerations in the design and installation of a UPS and associated equipment are discussed, safety aspects are included. DOE

N80-11799# National Technical Information Service, Springfield, Va.

THE USE OF COMPUTERS IN SOLVING MATHEMATICAL PROBLEMS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS *Progress Report, 1976 - Jul. 1979*

George W. Reimherr Aug. 1979 115 p Supersedes NTIS/PS-77/0780; NTIS/PS-76/0667; NTIS/PS-75/485; COM-74-11454; NTIS/PS-78/0782
(NTIS/PS-79/0798/3; NTIS/PS-78/0782; NTIS/PS-77/0780; NTIS/PS-76/0667; NTIS/PS-75/485; COM-74-11454) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Reports are cited on the computer solution of algebraic and differential equations. The necessary software and hardware for implementation, as well as solutions to large sparse matrices,

stiff differential equations, and statistical problems, are included. Some of the research is directly applicable to various physical sciences. This updated bibliography contains 107 abstracts, 13 of which are new entries to the previous edition. GRA

N80-11800# National Technical Information Service, Springfield, Va.
COMPUTER STORAGE MANAGEMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Brian Carrigan Sep. 1979 215 p Supersedes NTIS/PS-78/0803, NTIS/PS-77/0775, NTIS/PS-76/0669, NTIS/PS-75/528 and NTIS/PS-74/095
(NTIS/PS-79/0804/1; NTIS/PS-78/0803; NTIS/PS-77/0775; NTIS/PS-76/0669; NTIS/PS-75/528; NTIS/PS-74/095) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Dynamic storage allocation, paging, interleaved memory, and virtual memory are covered in the citations. Also included are the necessary programs, compilers, and algorithms for implementation in various computer systems. This updated bibliography contains 209 abstracts, four of which are new entries to the previous edition. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-11801# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
SENS: A PACKAGE OF FORTRAN SUBROUTINES FOR *FUNCTIONAL SENSITIVITY ANALYSIS OF SYSTEMS OF* ORDINARY DIFFERENTIAL EQUATIONS
Ivith Ben-Arroyo and Duncan H. Martin Jan. 1979 41 p refs
(CSIR-SWISK-8) Avail: NTIS HC A03/MF A01

Three subroutines designed to facilitate assessment of the sensitivity of a system of ordinary differential equations to finite functional perturbations are presented. The division into three subroutines leaves the user considerable freedom of choice regarding both the frequency in time and comprehensiveness in space of the analysis. M.M.M.

N80-11802# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
AUGMENTED RESTRICTED LAGRANGIANS IN CONVEX PROGRAMMING
S. Zlobec (McGill Univ.) and B. D. Craven (Melbourne Univ.) Jan. 1979 20 p refs
(CSIR-TWISK-62) Avail: NTIS HC A02/MF A01

Augmented Lagrangians, from which certain terms have been omitted, are proposed. The stationary points of these augmented restricted Lagrangians identify the optimal solutions of convex programs. The results extend to abstract spaces and convex cones. An application is given to an optimal control problem. R.C.T.

N80-11803# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A NEW CLASS OF FEASIBLE DIRECTION METHODS
A. Ben-Tal (Technion - Israeli Inst. of Tech.) and S. Zlobec (McGill Univ.) Jan. 1979 27 p refs
(CSIR-TWISK-61) Avail: NTIS HC A03/MF A01

A class of feasible direction methods based on two characterizations of optimality in convex programming is introduced. These methods are capable of generating all feasible directions, including those along the boundary of the feasible set. K.L.

N80-11804*# ESPEE, Inc., Huntsville, Ala.
DATA ANALYSIS SOFTWARE FOR THE AUTORADIOGRAPHIC ENHANCEMENT PROCESS. VOLUMES 1, 2, AND 3, AND APPENDIX Final Report
S. P. Singh Nov. 1979 150 p
(Contract NAS8-33405; NASA Order H-30573-B)
(NASA-CR-161327) Avail: NTIS HC A07/MF A01 CSCL 09B

The computer software developed to set up a method for Wiener spectrum analysis of photographic films is presented. This method is used for the quantitative analysis of the autoradiographic enhancement process. The software requirements and design for the autoradiographic enhancement process are given along with the program listings and the users manual. A software description and program listings modification of the data analysis software are included. R.C.T.

N80-11805*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PREPARATION GUIDE FOR CLASS B SOFTWARE SPECIFICATION DOCUMENTS
Robert C. Tausworthe 1 Oct. 1979 85 p refs
(Contract NAS7-100)
(NASA-CR-162431; JPL-Pub-79-56) Avail: NTIS HC A05/MF A01 CSCL 09B

General conceptual requirements and specific application rules and procedures are provided for the production of software specification documents in conformance with deep space network software standards and class B standards. Class B documentation is identified as the appropriate level applicable to implementation, sustaining engineering, and operational uses by qualified personnel. Special characteristics of class B documents are defined. K.L.

N80-11806*# Science Applications, Inc., Huntsville, Ala.
NASA SOFTWARE SPECIFICATION AND EVALUATION SYSTEM DESIGN Final Report
31 Oct. 1979 20 p
(Contract NAS8-32526)
(NASA-CR-161335, SAI-80-743-HU) Avail: NTIS HC A02/MF A01 CSCL 09B

The Software Specification and Evaluation System (SSES) manager's guide is presented along with the NSSC-2 computer brochure. Development, evaluation, and modification of the SSES are summarized. K.L.

N80-11807# Northwestern Univ., Evanston, Ill.
ON SOFTWARE RELIABILITY MODELING Interim Report, 1 Aug. 1976 - 30 Sep. 1978
Stephen S. Yau and Terry E. MacGregor Jun. 1979 55 p refs
(Contract F30602-76-C-0397; AF Proj. 5581)
(AD-A072420; RADC-TR-79-127) Avail: NTIS HC A04/MF A01 CSCL 09/2

In this report, the concept of software reliability is discussed. Various software reliability models along with the basic philosophy of their development, their characteristics, and derived figures of merit are examined. These model's strengths and weaknesses are evaluated. Attempts for validating these models are discussed. GRA

N80-11808# Maryland Univ., College Park. Computer Science Center.
RELAXATION APPLIED TO MATCHING QUANTITATIVE RELATIONAL STRUCTURES
Les Kitchen Oct. 1978 26 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A071604; TR-707) Avail: NTIS HC A03/MF A01 CSCL 09/2

A relaxation process is applied to the problem of matching relational structures involving numeric quantities. The method is empirically shown to be very sensitive to the exact form of the updating rule used. However, with the proper updating rule, the method works well, and is remarkably tolerant of measurement errors. GRA

N80-11809# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.
A NORMATIVE COST-BENEFIT ANALYSIS OF THE SYSTEMATIC DESIGN METHODOLOGY
S. L. Huff May 1979 73 p refs
(Grant N00039-78-G-0160)
(AD-A072355; CISR-P010-7905-10; CISR-TR-10) Avail: NTIS HC A04/MF A01 CSCL 09/2

Complex design problems are characterized by a multitude of competing requirements. System designers, finding the scope of the problem beyond their conceptual abilities, frequently cope with this difficulty by decomposing the original design problem

into smaller, more manageable sub-problems. Functional requirements form a key interface between the system's users and its designers. This report proposes a systematic approach for the decomposition of the overall set of functional requirements into sub-problems to form a design structure that will exhibit the key characteristics of good design: strong coupling within sub-problems, and weak coupling between them. Recent work in the Systematic Design Methodology (SDM) project has led to certain extensions to the basic representational model. This report presents a normative cost-benefit analysis of the SDM. It is a decision support methodology for aiding a software designer in determining an optimal structuring of a system's functional requirements. A model-oriented, normative cost/benefit analysis of the SDM is presented. A set of three sub-models, pertaining to specification impact, procedural design impact, and maintenance/modification impact, are derived. These models attempt to capture, in functional form, the important quantifiable effects - both positive and negative - that ought to occur as a result of developing a system based on an optimal partitioning of requirements. A numerical example is included. GRA

N80-11810# Hughes Aircraft Co., Fullerton, Calif.
VALIDATION OF SOFTWARE RELIABILITY MODELS Final Technical Report, Oct. 1977 - Nov. 1978
R. E. Schafer, J. E. Angus, J. F. Alter, and S. E. Emoto Jun. 1979 201 p refs
(Contract F30602-77-C-0219; AF Proj. 5581)
(AD-A072113; FR-78-16-1263) Avail: NTIS HC A11/MF A01 CSCL 09/2

This report presents the results of a study and investigation of software reliability models. In particular, the purpose was to investigate the statistical properties of selected software reliability models, including the statistical properties of the parameter estimates, and to investigate the goodness of fit of the models to actual software error data. The results indicate that the models fit poorly, generally due to in most part the vagaries of the data rather than shortcomings of the models. GRA

N80-11811# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
A FORTRAN ALGORITHM FOR PLOTTING CONTOURS OVER A TRIANGULAR MESH Final Report, Jul. - Dec. 1978
Kervyn D. Mach Jun. 1979 31 p refs
(AD-A072525; AFAPL-TR-79-2057) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes a contour plotting algorithm for data distributed on a triangular mesh such as might occur from numerical solutions of partial differential equations over an irregular domain. The method of application is described and illustrated with examples. The algorithm requires considerable memory but very little execution time. Suggestions for reducing the memory requirements and a complete program listing are included. GRA

N80-11812# Rensselaer Polytechnic Inst., Troy, N. Y. Computer Research Lab.
AUTOMATIC DATA PROCESSING TECHNIQUES FOR GRAPHIC-DATA DISPLAY, GENERATION AND ANALYSIS Final Report, 1 Sep. 1975 - 31 Aug. 1978
Herbert Freeman Oct. 1978 24 p refs
(Grant AF-AFOSR-2937-76; AF Proj. 2304)
(AD-A072636; CRL-60; AFOSR-78-1445TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This is the Final Report for a research grant whose objective was the development of efficient computer techniques for the processing of line-drawing images. A variety of specific problems were investigated. These included improved coding techniques for cartographic data, the reconstruction of solid-object descriptions from multiple-image projections of the objects, the removal of hidden lines from projections of both planar-faced and curved-surface objects, the design of a line-drawing analysis language called CHAP and the development of a scheme for line-pattern classification. GRA

N80-11813# Naval Research Lab., Washington, D. C.
GRAFIT: A GENERALIZED GRAPHICS PACKAGE Interim Report
J. P. Boris, E. Dent, M. J. Fritts, I. Haber, and W. W. Jones 20 Jul. 1979 62 p
(RR0230101; RR0140302)
(AD-A072339; NRL-MR-4027) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report is a concise user Manual for the GRAFIT package of subroutines. GRAFIT is a simple system for generating computer-graphics magnetic tapes for the Stromberg-Carlson 4020 microfilm recorder, on-line Calcomp incremental plotter, page-plot graphs, or Tektronix plots. The system is designed to be very efficient so using it to generate movies on 16mm film is relatively inexpensive. Appendices A, B, C, and D discuss the use of GRAFIT with consideration of the necessary control language and with an example of rather general utility. GRA

N80-11814# Yale Univ., New Haven, Conn. Dept. of Computer Science.
SCHEDULING PARALLEL PROCESSES WITHOUT A COMMON SCHEDULER Final Report
George Holober and Lawrence Synder Jul. 1979 16 p refs
(Contract N00014-75-C-0752)
(AD-A072158; TR-154) Avail: NTIS HC A02/MF A01 CSCL 09/2

An algorithm which solves the critical section problem for distributed processes is presented. We extend the solution of Lamport LL76 by continuing to allow processes to access their respective critical sections in any arbitrary user-specified order, but with greatly reduced storage requirements for each process. In addition, we supply a facility for testing the presence of deadlock among processes waiting to enter their critical code. We show our scheme to be tolerant of several malfunctioning processors and derive an equation relating the probability of total system failure to the probability of many individual failures occurring simultaneously among the processors. GRA

N80-11815# Princeton Univ., N. J. Dept. of Statistics.
FORTRAN SUBROUTINES FOR M ESTIMATORS IN THE LINEAR MODEL
Alfio Marrazi Apr. 1979 14 p refs
(Grant DAAG29-76-G-0298)
(AD-A071744; TR-147; SER-2; ARO-14244-7-M) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes the computational methods used in programming a set of subroutines to solve linear least squares problems and their robust versions by use of M estimators. GRA

N80-11816# Bettis Atomic Power Lab., West Mifflin, Pa.
MDSFP: A COMPUTER PROGRAM FOR ELASTIC SOLUTION OF THREE DIMENSIONAL STRUCTURES BY THE FINITE ELEMENT METHOD (LWBR DEVELOPMENT PROGRAM)
R. M. Clark Feb. 1979 209 p refs
(Contract EY-76-C-11-0014)
(WAPD-TM-1187) Avail: NTIS HC A10/MF A01

A computer program that solves linear elastic, small deflection, three dimensional structures by the finite element method is presented. The idealized model may consist of a mixture of beam, plate, and shell elements connected at node points. Structure loadings are represented by point or distributed loads, temperature distribution, and support displacements. Stresses are calculated from elastic strains which are calculated from nodal displacements. DOE

N80-11817# California Univ., Livermore. Lawrence Livermore Lab.
FUTURE TRENDS IN DATA BASE SOFTWARE
S. E. Jones 1979 16 p refs Presented at 20th AESOP Conf., Gatlinberg, Tenn., 24 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-82619; Conf-790431-2) Avail: NTIS HC A02/MF A01

In the 1970's, the Data Base Management System (DBMS) became a major software component in most commercial computing facilities, and is now becoming more widely used in scientific computing. This paper assesses the trends in DBMS research to infer the type of software that will be available in coming years. The very exciting area of data management functions implemented in hardware is only mentioned briefly. The relational

model is discussed because much of the current research is based on this model and its terminology. While the relational approach is not necessarily the wave of the future, its impact is being and will be felt. DOE

N80-11818# California Univ., Berkeley. Lawrence Berkeley Lab.
COMPUTER MAPPING SOFTWARE AT THE LAWRENCE BERKELEY LABORATORY
P. M. Wood and W. H. Benson Jun. 1978 48 p Presented at Harvard Computer Graphic Week Conf., Cambridge, Mass., 23 Jul. 1978
(Contract W-7405-eng-48)
(LBL-7938; Conf-780749-2) Avail: NTIS HC A03/MF A01

A number of FORTRAN mapping program useful for preparing base files and displays of statistical data are reviewed. Digitizing and editing of geographic base files is maintained by the programs MAPEDIT and ZING. Display of statistical attributes of discrete points, lines, or areas in two dimensions is done by the program CARTE. Display in three dimensions or of surfaces is accomplished using subroutines from the integrated data display system. All the programs use a device independent graphics system, GRAFPAC. DOE

N80-11819# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatiale.
SPHEROIDAL FUNCTIONS. THEORETICAL STUDIES AND COMPUTATIONAL TECHNIQUES [PRESENTATION DES FONCTIONS SPHEROIDES: ETUDES THEORIQUES ET OUTILS DE CALCUL]
Paulette Dorio and Colette Soubry Mar. 1979 186 p refs In FRENCH; ENGLISH summary
(CNES-NT-88) Avail: NTIS HC A09/MF A01

The general properties of spheroidal wave functions and related work are reviewed. The formulas and algorithms necessary for the numerical evaluation of these functions on a CDC 7600 computer are also presented. Subjects discussed include the equations from which spheroidal wave functions are derived, approximations by other special functions, double orthogonality as regards the intervals (-1, +1) and (- infinity, + infinity), and the normalization coefficients with respect to the intervals. The eigenvalues of spheroidal wave functions are then given and it is shown that these functions form complete function bases on the intervals defined. The software developed using FORTRAN on a CDC 7600 computer is described and numerical results obtained are reported and compared with other published results. Results coincide to 12 and 14 significant figures. Author (ESA)

N80-11820# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany). Inst. fuer Mathematik.
RAVAGE. A SUBROUTINE LIBRARY FOR COMPUTER GENERATION OF RANDOM NUMBERS, RANDOM VARIABLES, RANDOM VECTORS AND STOCHASTIC PROCESSES
Ion Vaduva (Bucharest Univ.) 1977 67 p refs
(SMD-Mitt-39) Avail: NTIS HC A04/MF A01

A subroutine library for computer generation of random variables, random vectors, stochastic processes, and other stochastic elements is presented. The subroutines selected and included in the library cover only the most important types of random variables, random vectors, and stochastic processes. Additions of other types of random elements to the library are discussed. The algorithms were collected from different books and papers which are given in the bibliography. FORTRAN was used for the coding. The statistical distributions used along with a short description of each subroutine and its auxiliary or preparatory subroutines are introduced. All subroutines are listed in the contents. Author (ESA)

N80-11821# Uppsala Univ. (Sweden). Inst. of Technology.
AN INTERACTIVE FRAMEWORK FOR DESIGN AUTOMATION
Bjoern Pehrson May 1978 24 p refs
(UPTEC-78-47-R) Avail: NTIS HC A02/MF A01

The architecture of an integrated interactive system for use in computer aided design of control computer systems and other design engineering applications is presented. The design process is structured into the modeling synthesis, and the implementation phases. A human oriented dialogue system comprised of different design descriptions is emphasized as essential to computerized design. Suitable information structures and programming languages for the implementation of such a system are discussed. Author (ESA)

N80-11822# Research Inst. of National Defence, Stockholm (Sweden).
USER'S MANUAL FOR THE COMPUTER PROGRAM TODEP [ANVAENDARHANDLEDNING FOER PROGRAMMET TODEP]
Bo Einarsson and Sven-Olaf Staahl Jun. 1979 76 p refs In SWEDISH
(FOA-C-20308-D4) Avail: NTIS HC A05/MF A01

An up to date users manual for the TODEP, TOREZ, and TOPLOT computer programs was prepared in order to overcome some errors and difficulties observed in the program applications and to adapt the manual to succesive modifications and improvements of the programs. The TODEP program is for studying two dimensional wave propagation and distortion, while TOREZ is used for rezoning the corresponding Lagrange nets. The TOPLOT program is used for plotting the results. Changes in the user's manual result in simplification of data inlet, equalizing running intervals, and improving overall computer performance. These programs are written in Fortran 4 language for an IBM 370 computer. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N80-11823# Fiat Research Center, Turin, Italy. Centro Informazione Tecnica.
THE DATA BANKS. WHAT THEY ARE AND HOW THEY ARE USED [LE BANCHE DATI. COSA SONO E COME SI UTILIZZANO]
Bruno Zambon Mar. 1979 243 p refs In ITALIAN
Avail: NTIS HC A11/MF A01

A detailed panoramic description of data banks and their utilization is presented. Information retrieval, data banks and host computers, communication with host computers (LIS, SDC, and IRS), conversational systems (Dialog, Orbit, Recon), installation and management of online information retrieval systems, systems limitations, practical examples of bibliographic research, and nonbibliographic databases online, are discussed. Author (ESA)

N80-11824# Fondazione Ugo Bordoni, Rome (Italy).
THE USE OF COMPLEX NUMBERS IN A NETWORK FLOW ALGORITHM [IMPIEGO DEI NUMERI COMPLESSI IN UN ALGORITMO DI FLUSSO]
Piero Filipponi and Francesco Mazzarella Dec. 1977 26 p refs In ITALIAN
(FUB-49-1977) Avail: NTIS HC A03/MF A01

In order to solve an optimization problem of reserve networks by means of a computer, the capacity and data flow were expressed by complex numbers, modifying a standard algorithm. The initial problem, the algorithm used, and the corresponding computer program are described. The program is parametric and can work with an arbitrary number of nodes. FORTRAN 5 language and UNIVAC computers were used. The results obtained with several test networks are presented. Author (ESA)

N80-11825# Fondazione Ugo Bordoni, Rome (Italy).
CONTROL PROCEDURES IN PACKET SWITCHED COMPUTER NETWORKS: PART 2 [PROCEDURE DI CONTROLLO NELLE RETI A COMMUTAZIONE DI PACHETTO (PARTE SECONDA)]
Nicola Accarino, Maurizio Decina (Rome Univ.), and Claudio Rossi Aug. 1978 74 p In ITALIAN
(FUB-15-1978-Pt-2) Avail: NTIS HC A04/MF A01

The main control procedures used on packet switched networks are described. International regulations governing public networks are referred to in particular. Flow control at several hierarchic levels, window data flow control at levels n = 3 and n = 2, invariant and adoptive routing procedures, arithmetic

data flow control, and the efficiency of the various data flow control procedures are discussed. Author (ESA)

N80-11826# Fondazione Ugo Bordoni, Rome (Italy).
ANALYSIS AND SYNTHESIS PROBLEMS IN DIMENSIONING PACKET SWITCHED NETWORKS [PROBLEMI DI ANALISI E DI SINTESI NEL DIMENSIONAMENTO DELLE RETI A COMMUTAZIONE DI PACCHETTO]
Nicola Accarino, Maurizio Decina (Rome Univ.), and Claudio Rossi Sep. 1978 96 p refs In ITALIAN
(FUB-32-1978) Avail: NTIS HC A05/MF A01

The problems inherent to packet switched network design are reviewed. Definitions, lag time, cost, throughput, and reliability are discussed. Boundary problems; network classification; capacity optimization; linear, concave, and discrete cost-capacity functions; flow optimization; a flow deviation method; and the properties of the local minimum and general algorithm for its determination are then discussed. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N80-11827# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OPTIMAL FEEDBACK CONTROL LAWS USING RANDOM SAMPLING OF THE OBSERVATION
Yaakov Yavin Feb. 1979 29 p refs
(CSIR-TWISK-63) Avail: NTIS HC A03/MF A01

It is assumed that a control object is described by the system of nonlinear stochastic equations dx = >f(x) + v(z)<dt + sigma(x)dW, t > 0, x, z epsilon R sub n, where W is a vector of independent standard Wiener processes and v is the control vector. It is further assumed that the process Z is observed, described by dz(i) = x(i)dN(i) + gamma (i) (x)dB(i), 1,...,n, x,z epsilon R sup n, where B = col. [B (1), ...B(n)] is a vector of independent standard Wiener processes and N = col. [N(1), ...,N(n)] is a vector of doubly stochastic Poisson processes with intensity [(lambda (1) Z (t), ..., lambda (n) Z (sub t), t > or equals 0]. It is shown how the process N can be constructed, and for a given sampling process N, sufficient conditions are derived on optimal controls. In addition, the problem is dealt with in selecting an optimal sampling process N for a given admissible control law. Author

N80-11828# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
MINIMUM L-p-NORM CONTROLS FOR TIME-VARYING LINEAR DYNAMIC SYSTEMS
D. H. Jacobson Sep. 1978 12 p refs Sponsored in part by Control Data
(CSIR-TWISK-49) Avail: NTIS HC A02/MF A01

The problem is considered of determining a control function which derives a linear dynamic system from an initial state to a desired state in specified time and which minimizes the integral of a strictly convex, co-finite function of the control. Existence and uniqueness of the optimal control are proved under mild assumptions, considerably weaker than those in a related paper by Brockett. A constructive, globally convergent algorith is provided for computing the optimal control. Minimum L(p) norm controls are obtained for special choices of the performance functional integrand. Author

N80-11829# Brown Univ., Providence, R. I. Div. of Engineering.
CONTROL OF NONLINEAR SYSTEMS Progress Report, 1 May 1977 - 30 Sep. 1978
Allan E. Pearson 13 Oct. 1978 14 p refs
(Grant AF-AFOSR-2793-75)
(AD-A072635; AFOSR-78-1443TR; PR-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

Results are summarized for the feedback stabilization of linear time varying differential and discrete-time linear systems, as well as a class of differential-delay systems. Extensions are described for a control law which tolerates a large class of nonlinearities in the loop without destroying stability. Research results are also described for the control of a class of intercept systems, including its interpretation as a commutative bilinear system, and a feedback control law, which incorporates least squares estimation of the target speed and turning rate. Results are described for parameter identification of a class of nonlinear systems, with particular attention given to the identification of parameters for a helicopter system in longitudinal motion, using input-output data on a finite time interval. Extensions to a signal estimation problem are indicated. GRA

N80-11830# Brown Univ., Providence, R. I. R. I. Lefschetz Center for Dynamical Systems.
MEASURE-VALUED PROCESSES IN THE CONTROL OF PARTIALLY-OBSERVABLE STOCHASTIC SYSTEMS Interim Report
Wendell H. Fleming Jun. 1979 30 p refs
(Grants AF-AFOSR-3063-77; NSF MCS-76-07261; AF Proj. 2304)
(AD-A072070; AFOSR-79-0849TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper is concerned with the optimal control of continuous-time Markov processes. The admissible control laws are based on white-noise corrupted observations of a function on the state processes. A 'separated' control problem is introduced, whose states are probability measures on the original state space. The original and separated control problems are related via the nonlinear filter equation. The existence of a minimum for the separated problem is established. Under more restrictive assumptions it is shown that the minimum expected cost for the separated problem equals the infimum of expected costs for the original problem with partially observed states. GRA

N80-11831# Naval Research Lab., Washington, D. C.
INFORMATION THEORETIC APPROXIMATIONS FOR M/G/1 AND G/G/1 QUEUING SYSTEMS Final Report
John E. Shore 18 Jul. 1979 40 p refs
(RR0140941)
(AD-A072338; NRL-MR-4047) Avail: NTIS HC A03/MF A01 CSCL 12/1

The behavior of single server queuing systems is characterized by various performance distributions, including distributions of queue length, waiting time, residence time, busy period, number served in a busy period, etc. In principle, if the arrival and service time distributions are known exactly, then these performance distributions can be computed using standard techniques. We consider the problem of estimating the distributions when only the first few moments of the service time distribution are known. Our approach uses standard relations to compute moments of the performance distributions from the known moments of the service time distribution and the principles of maximum entropy and minimum cross-entropy to estimate the performance distributions themselves. For M/G/1 systems with known average arrival rates, we derive analytic results for cases when one or two moments of the service time distribution are known, and we show how one can compute results using as many moments of the service time distribution as are available. For G/G/1 systems, our results are limited to the case in which only the average arrival and service rates are known. Among the results obtained with this information, theoretic approach is a new light-load approximation for the M/M/1 busy period probability density. Throughout the paper, we illustrate our approach using M/M/1, M/H2/1, and M/D/1 examples. GRA

N80-11832# Maryland Univ., College Park. Computer Science Center.
ARCHITECTURE FOR HIGHER LEVEL DIGITAL IMAGE PROCESSING Quarterly Status Report
Thomas J. Willett 30 Jul. 1978 66 p refs Prepared in cooperation with Westinghouse, Baltimore, Md.
(Contract DAAG53-76-C-0138)
(AD-A071599; QSR-1) Avail: NTIS HC A04/MF A01 CSCL 05/8

The report begins with a review of desired system design goals. This is followed by a description of available microprocessor hardware, a review of LISP approach to the manipulation of list structures, and a preliminary discussion of the processing required

to implement relaxation methods of object classification. The report concludes with a description of specific bit-slice processors. GRA

N80-11833# Colorado Univ. at Boulder. Dept. of Electrical Engineering.
QUANTITATIVE SYNTHESIS OF MULTIPLE LOOP FEEDBACK SYSTEMS WITH LARGE PLANT UNCERTAINTY Interim Report
Te-Shing Wang and Isaac Horowitz Jun. 1979 194 p refs (Contract AF-AFOSR-2946-76; AF Proj. 2304)
(AD-A072644; AFOSR-79-0880TR) Avail: NTIS HC A09/MF A01 CSCL 13/8

This work extends single input-output linear time invariant minimum-phase quantitative feedback synthesis to two new complex plant structures with internal sensing points. One is the triangular structure. The second consists of parallel branches, each with cascaded sections. Due to uncertainty, the plant parameters are elements of given sets. The system response must satisfy specified time or frequency domain tolerances. The basic problem is how to divide the feedback burden among the available loops so as to minimize the net rms effect at the plant input, of the various sensor noise sources. GRA

N80-11834# Uppsala Univ. (Sweden). Inst. of Technology.
ON THE ACHIEVABLE ACCURACY IN STOCHASTIC CONTROL
P. E. Moden and T. Soederstroem Apr. 1978 37 p refs (Contract SWEDBTD-73-4381)
(UPTEC-78-23-R) Avail: NTIS HC A03/MF A01

Two ways of designing controllers for linear stochastic discrete time are compared. One method, ordinary linear quadratic control, means minimization of the expected value of quadratic forms. For the other method the expectation is taken conditionally on all old measured data. The weights on the quadratic forms are used as free design variables. It is shown that the use of ordinary linear quadratic control in general gives superior behavior for a closed loop system. The use of conditional expectation often gives reasonable results for systems with a positive real transfer function. For first order systems the same set of regulators can be obtained with both methods. The analysis is supported with numerical examples illustrating the results. Author (ESA)

N80-11016 Allerton Press, Inc., New York, N. Y.
OPTIMAL OBJECT CONTROL WITH WORST RANDOM PARAMETER DISTRIBUTION
V. I. Timofeev and S. M. Chernyavskii *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 78-83 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 97-103 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-11835# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
ASPECTS OF A MULTI-CRITERION SECRETARY PROBLEM
T. J. Stewart Sep. 1978 29 p refs
(CSIR-TWISK-42) Avail: NTIS HC A03/MF A01

The selection of the most satisfactory from a random sequence of objects when these are evaluated according to a number of different criteria is presented. Various proposed methods of multi-criterion decision making are applied, and when evaluation is based on ranking only, procedures are very robust, and fairly simple. For the multi-criterion problem, however, ranking has the disadvantage that no allowance is made for differences in the range of options available for different attributes. On the other hand, rules based on measured values are difficult to implement. Such values can be used to determine criterion weights which can be incorporated into the rank-based procedures. M.M.M.

N80-11836# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
NOETHER'S THEORY IN CLASSICAL NONCONSERVATIVE MECHANICS
R. Roesel Feb. 1979 21 p refs
(CSIR-TWISK-66) Avail: NTIS HC A02/MF A01

Using the Hamiltonian formalism, it was found that a group of transformations which leaves the action integral of a nonconservative mechanical system invariant, generally does not leave the equations of motion invariant. R.C.T.

N80-11837# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
FUNCTIONAL SENSITIVITY FOR ORDINARY DIFFERENTIAL EQUATIONS
D. H. Martin Jan. 1979 46 p refs
(CSIR-TWISK-65) Avail: NTIS HC A03/MF A01

Systems of nonlinear ordinary differential equations in normal form, with prescribed initial 'state' x sub 0 and given time interval (t sub 0, t sub f) are considered. The sensitivity of the corresponding final state x sub f to arbitrary functional perturbations in the right-hand sides of the differential equations is addressed. It is assumed that a suitable Riemannian measure of distance between points in state space has been chosen, and in terms of this measure, a scalar function r(.), called the insensitivity function, is defined in a deleted neighborhood of x sub f. The behavior of this function characterizes the insensitivity of x sub f to finite functional perturbations to the right-hand sides of the differential equations. As the state x approaches x sub f in the direction of a vector Si, r squared (x) approaches a value which is the ratio of a positive definite quadratic form in Xi to the square of the Riemannian norm of Xi. The coefficients of this quadratic form, which are easily computed, define the insensitivity tensor at x sub f, and this provides a convenient description of the sensitivity of the final state in each direction. J.M.S.

N80-11838# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OBSERVABILITY WITH CONIC OBSERVATION SET
M. Pachter and D. H. Jacobson Jan. 1979 10 p refs Sponsored in part by Control Data
(CSIR-TWISK-59) Avail: NTIS HC A02/MF A01

A geometric proof of Brammer's theorem on observability with a conic observation set is given. It is shown that Brammer's result is generalized because it is not required that the observation cone be polyhedral. J.M.S.

N80-11839# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
M-ESTIMATION IN THE PRESENCE OF UNEQUAL SCALE
Noel Cressie (Flinders Univ.) Jan. 1979 19 p refs
(CSIR-TWISK-60) Avail: NTIS HC A02/MF A01

The class of weighted M-estimators is defined. The ratio of the asymptotic variance of the weighted estimator to the asymptotic variance of the optimally weighted estimator is defined as the inefficiency. A Kantorovich inequality is proved, and its implications are investigated for the misweighted mean and misweighted median. Author

N80-11840# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
COLLECTIVE STATES AND CROSSING SYMMETRY
W. D. Heiss Jan. 1979 29 p refs
(CSIR-TWISK-58) Avail: NTIS HC A03/MF A01

Results are presented which were obtained with a model for the vertex function, such that crossing symmetry is implemented to lowest order. While in the model the vertex function obeys neither an s-channel nor a t-channel integral equation, it satisfies an equation in which the two channels are treated simultaneously and in a symmetric way. The s-channel and t-channel two particle propagators are calculated from the same vertex function. In comparison with the respective RPA-propagators the numerical results obtained within a schematic model show a remarkable effect at the higher levels of the respective energy spectra, while at the lower levels only the

residues of the propagators are strongly affected. The sum rules are satisfied to within + or -1%. The pole structure of the single-particle self-energy differs considerably from that which follows from the weak coupling approach. Author

N80-11841# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
VERTEX FUNCTION AND CROSSING SYMMETRY
W. D. Heiss Oct. 1978 23 p refs
(CSIR-TWISK-53) Avail: NTIS HC A02/MF A01

An integral equation for the vertex function occurring in the quantum mechanical many-body problem is proposed. The s-channel and the t-channel are treated simultaneously and on the same level. An intricate blending of the two channels is provided by the equation. Its solution is given in closed form, and although this is complicated, it allows the physically interesting features to be investigated numerically. R.C.T.

N80-11842# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
ON THE REGULARITY AND APPROXIMATION OF THE SOLUTIONS OF SOME OPTIMAL CONTROL PROBLEMS GOVERNED BY ELLIPTIC EQUATIONS
Tunc Geveci Sep. 1978 37 p refs
(CSIR-TWISK-47) Avail: NTIS HC A03/MF A01

Regularity results are obtained for the solutions of some optimal control problems governed by elliptic equations. Error estimates for approximate solutions, using Fenchel-Rockafellar duality theory are also obtained. F.O.S.

N80-11843# Hughes Research Labs., Malibu, Calif.
STUDY OF BOUNDARY STRUCTURES Final Report, 1 May 1976 - 30 Apr. 1979
Ryoichi Kikuchi Jun. 1979 155 p refs
(Contract DAAG29-76-C-0026)
(AD-A071710; ARO-13252.6-P) Avail: NTIS HC A08/MF A01 CSCL 12/1

The scalar product (SP) formulation evaluates the boundary free energy sigma using the properties of only the two homogeneous phases (without explicitly calculating the boundry profile) that meet at the boundary. The SP method is explored in detail and is now considered ready for further use. The boundary profile can be calculated using the sum method. How to formulate this method using the cluster variation method (CVM) and the natural iteration method (NIM) is presented. GRA

N80-11844# Southern Methodist Univ., Dallas, Tex. Dept. of Operations Research.
COMPUTER GENERATION OF BIVARIATE GAMMA RANDOM VECTORS
Bruce W. Schmeiser and Ram Lal Jul. 1979 38 p refs
(Contract N00014-77-C-0425)
(AD-A072407; OR-79009) Avail: NTIS HC A03/MF A01 CSCL 12/1

The use of bivariate gamma distributions in simulation modeling is considered. A family of algorithms is given, any member of which can be used to generate random bivariate vectors having any gamma marginal distributions and any theoretically possible correlation, both positive and negative. Computational considerations are discussed, including the selection of parameters to provide regression curves consistent with the modeler's needs. A modification which is easier to implement and provides most, but not all, correlations is also given. Finally the use of these algorithms to generate first order autoregressive time series is discussed. GRA

N80-11845# Tennessee Univ., Knoxville. Dept. of Psychology.
METHOD OF MOMENTS AS THE LEAST SQUARES SOLUTION FOR FITTING A POLYNOMIAL
Fumiko Samejima and Philip Livingston 16 Jun. 1979 137 p refs
(Contract N00014-77-C-0360; RR0420401)
(AD-A072357; RR-79-2) Avail: NTIS HC A07/MF A01 CSCL 12/1

Methods of moments have been used frequently and effectively in our previous research for developing theories and methods of estimating the operating characteristics of the item response categories and ability distributions. It has been discovered that the method is quite useful, for fitting some curves to the set of observations, like maximum likelihood estimates, to the unobserved, conditional density function of which only the first few moments are estimated, and to the resultant, estimated density function of ability. It has also been discovered that polynomials are useful as functions to fit in applying the method of moments, with their unrestricted nature, regardless of the fact that there always is a possibility that they produce negative values for the estimated density. In the present paper, it is pointed out that a polynomial fitted by the method of moments is the same polynomial produced by the least squares principle. Using some examples, the two processes, i.e., the method of moments and the least squares solution, are compared. It is pointed out that, in general, the method of moments provides us with a simpler process and a more accurate result, than the least squares method, when the computer work is involved. The importance of using the appropriate interval in applying the method of moments, and the least squares method, is emphasized. GRA

N80-11846# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
TESTING TRANSFORMATIONS TO ACHIEVE APPROXIMATE NORMALITY Interim Report
Raymond J. Carroll Aug. 1978 13 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 2304)
(AD-A072596; Mimeo-Ser-1190; AFOSR-78-1436TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

We propose a competitor to likelihood and significance methods for power transformations to achieve approximate normality in a linear model. The new method is shown in theory and a Monte-Carlo experiment to produce more robust inferences than the likelihood method and considerably more powerful (although possibly slightly less robust) inferences than the significance method. GRA

N80-11847# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
AN EFFICIENT CONTENTION RESOLUTION ALGORITHM FOR MULTIPLE ACCESS CHANNELS M.S. Thesis
Jeannine Mosely Jun. 1979 85 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A072440; LIDS-TH-918) Avail: NTIS HC A05/MF A01 CSCL 12/1

In this thesis, the general form of a first-come first-served contention resolution algorithm is given. A sub-class of FCFS algorithms, called single interval algorithms, are analyzed using Markovian decision theory. It is seen that, if the horizon is infinite, Humblet's algorithm has the maximum throughput for this sub-class. However, if the system is shut down after a finite number of transmissions, then an extended version of his algorithm is optimal. GRA

N80-11848# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
AN INVESTIGATION INTO THE EFFECTS OF ASYMMETRY ON ROBUST ESTIMATES OF REGRESSION Interim Report
Raymond J. Carroll Aug. 1978 26 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 2304)
(AD-A072597; MIMEO-SER-1172; AFOSR-78-1431TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

We investigate the effects of asymmetry errors on robust regression estimates. Theoretical and Monte-Carlo results show that slopes are essentially unaffected, but that the intercept has a bias and its variance is difficult to access. GRA

N80-11849# Purdue Univ., Lafayette, Ind. Dept. of Mathematics.
AN APPROXIMATION TECHNIQUE FOR SMALL NOISE OPEN LOOP CONTROL PROBLEMS Interim Report
Charles J. Holland 1978 16 p refs
(Grant AF-AFOSR-3286-77; AF Proj. 2304)
(AD-A072638; AFOSR-78-1444TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper is concerned with the development of an approximation technique for the solution of a class of fixed stopping time small noise open loop control problems. These

problems arise by adding an additive white noise term with a small coefficient sq rt (2 epsilon) I to the system equations in the deterministic control problem. An approximation scheme is developed that has the advantage that one finds approximately optimal controls simultaneously for all sufficiently small epsilon. The scheme requires the solution of a generalized linear regulator problem which is solvable easily numerically. The numerical method is also presented. GRA

N80-11850# Science Applications, Inc., Monterey, Calif.
THE ROLE OF THE ASYMMETRIC TERMS OF THE DIVERGENCE AND VORTICITY EQUATIONS IN THE ZERO LAPLACIAN VORTEX
Francis H. Nicholson Nov. 1978 42 p refs
(Contract N00014-78-C-0393)
(AD-A072452) Avail: NTIS HC A03/MF A01 CSCL 12/1

The generation of divergence, and to a lesser extent, vorticity, are highly dependent upon the development of asymmetries in this model. Because of the laborious mathematical analysis, a numerical model should be parameterized using the asymmetries of this model to assess their contributions to the heat, momentum and water vapor budgets of the hurricane. GRA

N80-11851# Polytechnic Inst. of New York, Brooklyn. Dept. of Mathematics.
APPROXIMATIONS OF NORMAL RANGE REVISITED WITH NEW TABLES FOR d SUB 2 AND d SUB 3 - FACTORS
John H. K. Kao 19 Jan. 1979 28 p refs
(Contract N00014-77-C-0601)
(AD-A073004; POLY/MA-79-2) Avail: NTIS HC A03/MF A01 CSCL 09/1

Patnaik's X-approximation and Cox's X-squared-approximation to the normal mean range are revisited and many inaccurate entries discovered. Investigations revealed, among other reasons, that the original Tippett's calculations on d2 and d3 -factors were of inadequate accuracy. New tables for d2 and d3-factors as well as constants associated with Patnaik's and Cox's approximations are recomputed and tabulated . These new tables will be useful for revising the MIL-STD-414 range plans for inspection by variable and for the analysis of variance tests when ranges or mean ranges are used in place of sample variances or standard deviations, as well as for constructing limits for the cumulative sum charts for range variability. GRA

N80-11852# Brown Univ., Providence, R. I. Dept. of Physics.
UNITARITY RESTRICTIONS ON SEMI-CLASSICAL APPROXIMATIONS TO CERTAIN FUNCTIONAL INTEGRALS
H. M. Fried 1978 5 p refs Presented at Conf. on Math. Probl. in Feynman Path Integrals, Marseille, May 1978
(Contract EY-76-C-02-3130)
(COO-3137A-343; Conf-7805151-1) Avail: NTIS HC A02/MF A01

Estimates of physically relevant quantities (cross sections, multiplicities, correlations) in eikonal models of high-energy field theories lead to a class of semiclassical solutions to nonlinear Euler equations. The requirement of unitarity restricts these possible solutions to a unique function of energy and impact parameter. DOE

N80-11853# Bari Univ. (Italy). Ist. di Macchine.
ON THE NUMERICAL SOLUTION OF CAUCHY INTEGRALS
Michele Napolitano Apr. 1978 17 p refs
(Contract CNR-77-0095)
Avail: NTIS HC A02/MF A01

The development of a reliable second order accurate Cauchy integral solver is discussed. The singular logarithmic behavior of the integral is extracted analytically and the residual regular function is numerically integrated by standard techniques. It is shown that simple trapezoidal rule integration leads to first order accurate behavior instead of to second order behavior as expected; such an anomaly is explained as due to the singular nature of the integrand. A general approach for obtaining consistent second order accuracy is presented and tested on linear airfoil integrals for which the exact solution is available. Also a vectorization of the logarithms, suitable for very efficient use within a complex iterative algorithm, is presented. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-11854# Florida State Univ., Tallahassee. Dept. of Statistics.
ON BERRY-ESSEN RATES FOR STATISTICAL FUNCTIONS, WITH APPLICATION TO L-ESTIMATES
Dennis D. Boos and R. J. Serfling Apr. 1979 15 p refs
(Contract N00014-76-C-0608)
(AD-A072131; FSU-Statistics-M499; TR-136-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A parameter expressed as a functional T(F) of a distribution function (d.f.) F may be estimated by the statistical function T(F sub n) based on the sample d.f. F sub n. Typically, T(F sub n) is asymptotically normal. We investigate the rate of this convergence by utilizing the von Mises representation to express T(F sub n) - T (F) as an approximate U-statistic plus R sub n, and applying the Berry-Esseen rate O(sq rt n) established for U-statistics by Callaert and Janssen. This essentially reduces the problem to a handling of R sub n. We carry out this method for linear functions of order statistics (L-estimates) and obtain results competitive with Bjerve and Helmers. Also, we briefly indicate the application of the method to M-estimates. GRA

N80-11855# Pittsburgh Univ., Pa. Dept. of Mathematics and Statistics.
MULTISTATE RELIABILITY MODELS
William S. Griffith and Henry W. Block Jul. 1978 19 p refs
(Contract N00014-76-C-0839)
(AD-A072303; RR-78-02) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper an axiomatic development of multistate systems is presented. Three types of coherence based on the strength of the relevancy axiom are studied. The strongest of these has been investigated previously by El-Neweihi, Proschan, and Sethuraman. One of the weaker types of coherence permits wider applicability to real life situations without sacrificing any of the mathematical results obtained by El-Neweihi, Proschan, and Sethuraman. The concept of system performance is formalized through expected utility and the effect of component improvement on system performance is studied using a generalization of Birnbaum's reliability importance. GRA

N80-11856# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
ON SEQUENTIAL CONFIDENCE INTERVALS FOR THE LARGEST NORMAL MEAN
Raymond J. Carroll Aug. 1978 20 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 2304)
(AD-A072599; MIMEO-SER-1191; AFOSR-78-1437TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

We construct a competitor to Tong's method for defining a fixed-width confidence interval for the largest normal mean. This competitor eliminates inferior populations early in the experiment; a Monte-Carlo experiment shows that it can use significantly fewer observations than Tong's method without any real loss in observed coverage probability. GRA

N80-11857# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
A STUDY OF SEQUENTIAL PROCEDURES FOR ESTIMATING THE LARGER MEAN
Raymond J. Carroll Aug. 1978 18 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 2304)
(AD-A072595; MIMEO-SER-1189; AFOSR-78-1435TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Blumenthal considered the problem of sequential estimation of the largest of k normal means when a bound is set on the acceptable mean square error. He showed that his procedure results in only a small savings in sample size when compared to a conservative fixed sample procedure for the case of known variance. Carroll criticized this procedure because it does not give the user the flexibility of sampling selectively from the k populations. Carroll defined a procedure which early in the experiment eliminates from further consideration those populations

which are obviously not associated with the largest mean and hence provide little relevant information; his theoretical large-sample calculations indicate possible large savings in sample size with no corresponding increase in mean square error. In this paper we contrast the small sample behavior of the two approaches by means of a Monte-Carlo simulation study; both known and unknown variance are considered. GRA

N80-11858# North Carolina Univ. at Chapel Hill. Dept. of Statistics.
INFERENCE UNDER ORDER AND SMOOTHNESS RESTRICTIONS WITH APPLICATIONS IN TIME SERIES ANALYSIS Final Report
Edward J. Wegman Oct. 1978 5 p refs
(Grant AF-AFOSR-2840-75; AF Proj. 2304)
(AD-A072594; AFOSR-78-1419TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Work began on this contract in the summer of 1975. Through the succeeding years, work has evolved in several directions. It is convenient to group the work into four related categories: (1) Nonparametric density estimation, (2) Probabilistic automata theory, (3) Isotonic inference and splines, and (4) Miscellaneous. GRA

N80-11859# Southern Methodist Univ., Dallas, Tex. Dept. of Operations Research and Engineering Management.
ANOTHER VERSATILE FAMILY OF PROBABILITY DISTRIBUTIONS
Bruce W. Schmeiser and Ram Lal Dec. 1978 17 p refs
(Contract N00014-77-C-0425)
(AD-A072406; OREM-78015) Avail: NTIS HC A02/MF A01 CSCL 12/1

A new four parameter family of probability distributions is described. Special cases include Bernoulli trials, uniform, power series, exponential, triangular and Laplace (double exponential) distributions. Statistical properties, parameter determination, and random variate generation are developed. GRA

N80-11860# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ON THE LENGTHS OF THE PIECES OF A STICK BROKEN AT RANDOM
Lars Holst (Uppsala Univ., Sweden) 21 May 1979 22 p refs
Prepared in cooperation with Goteborg Univ.
(CTH-Math-1979-13) Avail: NTIS HC A02/MF A01

The pieces of a randomly broken stick are considered. The length of the j the longest piece is determined and the exact distribution of the lengths is derived. It is noted that the analysis is particularly valid when the number of pieces is large. Also, moments of the lengths are obtained and some useful representations using independent exponential random variables are given. A necessary and sufficient condition for asymptotic normality is given and convergence of moments is obtained for linear combinations of length. The question of how many breaks are necessary to get all the pieces less than a certain length is also discussed. A limit distribution for the number of breaks is derived and convergence of moments is proved when the number tends to zero. The problem is also treated for the minimum number of arcs, having random length and placed at random on a circle of length one, needed in order to get complete coverage.
Author (ESA)

N80-11861# Goteborg Univ. (Sweden). Dept. of Mathematics.
REMAINDER TERM ESTIMATES IN ONE AND MANY-DIMENSIONAL RENEWAL THEORY
Hasse Carlsson 1979 61 p refs
Avail: NTIS HC A04/MF A01

Let X1, X2, ... be d-dimensional independent radom vectors with a common distribution mu. Let nu = the summation of n = 0 to infinity mu exponent N^* and, for d = 1, H(X) = NU (-infinity, X). The asymptotic behavior of NU (A+X) and H(X) as the absolute value of X tends to infinity are investigated. It is known that H(X) - X/mu sub 1 - mu sub 2/2 mu 1 to 2 tends to zero as X tends to + infinity if mu sub 1 > zero and mu is a non-lattice measure (mu sub k is the kth moment of mu). The rate of this convergence under further condition on mu is considered. The estimates are obtained by a Fourier transform technique making use of Bohr's inequality. The problem is also treated for d> or = 2. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-11862*# Old Dominion Univ. Research Foundation, Norfolk, Va.
A SUMMARY OF SPECTRAL SYNTHESIS PROCEDURES FOR MULTIVARIABLE SYSTEMS Final Report, 1 May 1978 - 15 Sep. 1979
S. R. Liberty, R. R. Mielke, and R. A. Maynard Nov. 1979 31 p refs
(Grant NsG-1519)
(NASA-CR-162436) Avail: NTIS HC A03/MF A01 CSCL 12B

A new approach to the eigensystem assignment problem is presented. The approach utilizes a null-space formulation of the eigenvalue/eigenvector assignment problem to simultaneously realize arbitrary eigenvalue specifications, approximate desired modal behavior, and achieve low eigensystem sensitivity with respect to plant parameter variations. The methods are applied to the design of regulator and integral plus proportional servo control systems. Author

N80-11014 Allerton Press, Inc., New York, N. Y.
ANALYTIC DESIGN OF COMPLEX SYSTEMS, 1
T. K. Sirazetdinov and A. I. Bogomolov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 67-73 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 83-91 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11020 Allerton Press, Inc., New York, N. Y.
ANALYTIC DESIGN OF REGULATORS FOR VARIABLE-PARAMETER SYSTEMS
A. A. Baloev *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 99-102 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 122-126 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-11863# Florida State Univ., Tallahassee. Dept. of Statistics.
TREND-FREE BLOCK DESIGNS: EXISTENCE AND CONSTRUCTION RESULTS
Ching-Ming Yeh and Ralph A. Bradley Jul. 1979 30 p refs
(Contracts N00014-76-C-0608; N00014-76-C-0394)
(AD-A072138; FSU-Statistics-M508; TR-141-ONR) Avail: NTIS HC A03/MF A01 CSCL 12/2

Designs for which treatment and block contrasts are orthogonal to specified common trend components within blocks have been called trend-free block designs. Necessary and sufficient conditions for the existence of such designs were given in a reference. A matrix sum was required to have certain properties. It is shown now that the existence of a matrix with the required properties assures the existence of the necessary component matrices. The existence of trend-free block designs for specified trends in one or more dimensions is examined in a number of theorems and corollaries. Initial results are general and then trends in one dimension are considered. An alternative formulation of the necessary and sufficient conditions for a trend-free block design is given when each treatment has the same number of replications. Some special results are obtained for complete and

balanced incomplete block designs. Youden Square designs are trend-free balanced incomplete block designs for up to p orthonormal, one-dimensional trend components, p - k, the block size. Some design construction methods are developed to establish the existence of certain trend-free block design. But, apart from the matter of treatment labelling, trend-free block designs may not be unique. The construction methods used may lead to designs particularly vulnerable to incorrect modelling of trend components. GRA

N80-11864# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
THEORY AND APPLICATIONS OF GENERALIZED WALSH FUNCTIONS IN DIGITAL SYSTEMS Final Report, 1 Mar. 1975 - 30 Apr. 1979
David K. Cheng Jun. 1979 30 p refs
(Grant AF-AFOSR-2809-75; AF Proj. 2304)
(AD-A072511; AFOSR-79-0916TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This is a final technical report on the theory and applications of generalized Walsh functions in digital systems. Research accomplishments in the areas of Walsh-Transform solution of difference equations; development of an algorithm for sequency ordering of Hadamard functions; development of a general two-parameter orthogonal transformation matrix; and analysis of the stochastic behavior of digital combinational circuits are summarized. Reprints are attached. GRA

N80-11865# Los Alamos Scientific Lab., N. Mex.
LIE-GROUP THEORY FOR SYMBOLIC INTEGRATION OF FIRST-ORDER DIFFERENTIAL EQUATIONS: A MODERN TREATMENT
W. A. Beyer 1979 35 p refs Presented at 2d MACSYMA Users Conf., Washington, D. C., 20 Jun. 1979
(Contract W-7405-eng-36)
(LA-UR-79-251; Conf-790629-2) Avail: NTIS HC A03/MF A01

The application of Lie group theory to the solution of first order ordinary differential equations (ODEs) is reviewed. A code written in the MACSYMA language is presented which finds and solves first order DOEs invariant under group with infinitesimal generation of the form U = A(x)B(y)delta/sub x/ + C(x)D(y)delta/sub y/. An algorithm is given by which one can begin with an ODE y prime = f(x,y) with known solution phi(x,y) = c and obtain a possibly larger class of ODEs with solutions given in closed form. A final algorithm for forming a sequence of solvable differential equations is suggested. The work can be generalized to higher order differential equations, partial differential equations, and difference equations. DOE

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-11866# California Univ., Livermore. Lawrence Livermore Lab.
MAGNETIC PROPULSION RAILGUNS: THEIR DESIGN AND CAPABILITIES
R. S. Hawke and J. K. Scudder 8 May 1979 32 p refs Presented at 2d Intern. Conf. on Megagauss Magnetic Field Generation and Related Topics, Washington, D. C., 29 May 1979
(Contract W-7405-eng-48)
(UCRL-82677; Conf-790540-7) Avail: NTIS HC A03/MF A01

An electromagnetic railgun which accelerates an electrically conducting armature which in turn accelerates a projectile is examined. The technical issues which control the dc railgun efficiency and performance are discussed. The areas studied include resistive heating and magnetic loading of the parallel rails; stress considerations within the rail support structure; interior ballistics of the projectile; and estimates of launcher performance as a function of input energy. A.W.H.

N80-11867# National Bureau of Standards, Boulder, Colo. Center for Electronics and Electrical Engineering.
ELECTROMAGNETIC BOUNDARY-VALUE PROBLEMS BASED UPON A MODIFICATION OF RESIDUE CALCULUS AND FUNCTION THEORETIC TECHNIQUES
James Patrick Montgomery and David D. Chang Jun. 1979 126 p refs
(PB-297305/5; NBS-MN-164; LC-79-600072) Avail: NTIS HC A07/MF A01 CSCL 20C

The solution to a number of electromagnetic problems, in both closed and open systems, is presented. Specific problems considered are: (1) the trifurcated waveguide; (2) the dielectrically loaded trifurcated waveguide; (3) the N-furcated waveguide; (4) the dielectrically loaded N-furcated waveguide; (5) determination of the eigenvalues of a ridged waveguide; (6) scattering by a dielectric stop; (7) a parallel plate radiating into a homogeneous halfspace; (8) a finite phased array; (9) remote sensing of the earth using parallel plate waveguides; (10) a flanged waveguide radiating into a half-space; (11) scattering by a thick, semi-infinite plane; and (12) radiation from a slot in a waveguide wall. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-11868*# Kentron International, Inc., Hampton, Va. Technical Center.
A METHOD FOR PREDICTING THE NOISE LEVELS OF COANNULAR JETS WITH INVERTED VELOCITY PROFILES
James W. Russell Washington NASA Oct. 1979 156 p refs
(Contract NAS1-13500)
(NASA-CR-3176) Avail: NTIS HC A08/MF A01 CSCL 20A

A coannular jet was equated with a single stream equivalent jet with the same mass flow, energy, and thrust. The acoustic characteristics of the coannular jet were then related to the acoustic characteristics of the single jet. Forward flight effects were included by incorporating a forward exponent, a Doppler amplification factor, and a Strouhal frequency shift. Model test data, including 48 static cases and 22 wind tunnel cases, were used to evaluate the prediction method. For the static cases and the low forward velocity wind tunnel cases, the spectral mean square pressure correlation coefficients were generally greater than 90 percent, and the spectral sound pressure level standard deviation were generally less than 3 decibels. The correlation coefficient and the standard deviation were not affected by changes in equivalent jet velocity. Limitations of the prediction method are also presented. R.C.T.

N80-11869*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A CLOSED-FORM SOLUTION FOR NOISE CONTOURS
Elwood C. Stewart and Thomas M. Carson Nov. 1979 40 p refs
(NASA-TP-1432; A-7660) Avail: NTIS HC A03/MF A01 CSCL 20A

An analytical approach for generating noise contours that overcome the difficulties of existing programs is described. This approach is valid for arbitrarily complex paths and reveals the importance of various factors that influence contour shape and size. The calculations are simple enough to be implemented on a small, hand-held programmable calculator, and a program for the HP-67 calculator is illustrated. The method is fast, simple, and gives the area, the contour, and its extremities for arbitrary flight paths for both takeoffs and landings. R.C.T.

N80-11870*# Lockheed-Georgia Co., Marietta.
STUDIES OF THE ACOUSTIC TRANSMISSION CHARACTERISTICS OF COAXIAL NOZZLES WITH INVERTED VELOCITY PROFILES, VOLUME 1 Final Report
P. D. Dean, M. Salikuddin, K. K. Ahuja, H. E. Plumblee, and P. Mungur Cleveland, Ohio NASA May 1979 186 p refs
(Contract NAS3-20797)

(NASA-CR-159898; LG79ER0178-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 20A

The efficiency of internal noise radiation through coannular exhaust nozzle with an inverted velocity profile was studied. A preliminary investigation was first undertaken to: (1) define the test parameters which influence the internal noise radiation; (2) develop a test methodology which could realistically be used to examine the effects of the test parameters; (3) and to validate this methodology. The result was the choice of an acoustic impulse as the internal noise source in the in the jet nozzles. Noise transmission characteristics of a nozzle system were then investigated. In particular, the effects of fan nozzle convergence angle, core extention length to annulus height ratio, and flow Mach number and temperatures were studied. The results are presented as normalized directivity plots. R.C.T.

N80-11871# Army Construction Engineering Research Lab., Champaign, Ill.

TRUE-INTEGRATING ENVIRONMENTAL NOISE MONITOR AND SOUND EXPOSURE LEVEL METER. VOLUME 2: WIRING AND PARTS LISTS, PARTS LAYOUTS, AND SCHEMATICS Final Report

Aaron J. Averbuch, Paul D. Schomer, and M. W. Weisberg Jun. 1979 176 p refs

(AD-A072002; CERL-TR-N-41-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 13/2

This report provides the complete hardware construction of the CERL environmental noise monitor. Included are: a task block diagram of the unit, a parts list and diagram of the front panel, a parts list and diagram of the power supply circuit, a list of the back plane wiring, parts list, layout, and schematics of the PC boards, and wiring list for cables and connectors. GRA

N80-11872# Defence Research Establishment Pacific, Victoria (British Columbia).

ACOUSTIC PHASE FLUCTUATIONS CAUSED BY GARRETT-MUNK INTERNAL WAVES

B. Hughes Mar. 1979 35 p refs

(AD-A071354; DREP-TM-79-1) Avail: NTIS HC A03/MF A01 CSCL 20/1

Perturbed acoustic propagation is considered between a point source and an array receiver in which the perturbations are due to a Garrett-Munk internal wave field. The resultant acoustic phase fluctuations along the array are determined. Straight ray propagation is assumed, and three array orientations are considered: broadside horizontal, end fire horizontal and broadside vertical. It is shown that for an acoustic frequency of 150 Hz, a range of 50 km and a horizontal broadside receiver separation distance (in the array) of 1 km, the rms phase difference between the two receivers at 1000 m depth in the N. Pacific is typically 5 deg, and in the Arctic it is typically 2 deg, whereas in the N. Atlantic at the same depth it is typically 50 deg. These geographical variations are due mainly to variations in the potential sound velocity gradient. Similar phase differences occur for a vertical receiver separation of 50 m. The horizontal receiver separation necessary to reduce the acoustic coherence to 0.5 for the same operating conditions is shown to be very large in the N. Pacific (about = 400 km) and Arctic (= 1000 km), but only 2.3 km in the N. Atlantic. GRA

N80-11873# Texas Univ. at Austin. Applied Research Labs.

DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL PARAMETRIC ACOUSTIC RECEIVING ARRAY (PARRAY) Final Technical Report, 5 May 1976 - 31 Jan. 1978

Tommy G. Goldsberry, C. Richard Reeves, David F. Rohde, M. Ward Widener, Robert A. Lamb, Voldi E. Maki, Jr., and Wiley S. Olsen 16 Feb. 1979 154 p refs

(Contract N00039-76-C-0231; DARPA Order 2910)

(AD-A072307; ARL-TR-79-5) Avail: NTIS HC A08/MF A01 CSCL 17/1

The development, test, and evaluation of an experimental parametric acoustic receiving array (PARRAY) with a pump-hydrophone separation of 340 m are described in this report. Tests in Lake Travis, Texas, demonstrated a greater than 40 dB reduction in the self-noise floor of the experimental PARRAY compared to any previous parametric acoustic receiver. This reduction in the self-noise floor was achieved through state-of-the-art advances in four major hardware subsystems employed in the experimental PARRAY: high spectral purity pump signal generation; commensurate power amplification; high efficiency, high power transducer element and array design; and detection of sideband signals with very small modulation indices. Design and test results are presented for a crystal controlled oscillator with spectrum level single sideband phase noise less than -170 dB referenced to the carrier level. The design of a band elimination receiver preprocessor capable of detecting sideband signals approaching 180 dB below the carrier is presented and discussed. Test results are presented for simple, high efficiency transducer elements and arrays. Tests and experiments that were performed to evaluate the experimental 340 m PARRAY are described. GRA

N80-11874# Texas Univ. at El Paso. Dept. of Physics.

ON THE DETERMINATION OF ARRIVAL TIMES FOR SOUND RANGING. 1: EFFECTS OF FINITE AMPLITUDE PROPAGATION, VERTICAL METEOROLOGICAL GRADIENTS, AND SYSTEM TRANSIENT RESPONSE

E. A. Dean May 1979 64 p refs

(Contract DAAG29-76-D-0100; DA Proj. 1L1-62111-AH-71)

(AD-A072600; ERADCOM/ASL-CR-79-0100-2) Avail: NTIS HC A04/MF A01 CSCL 17/1

Several factors bearing on the determination of arrival times in sound ranging are investigated. These factors include the propagation of a finite amplitude triangular shock wave, the diffraction due to the surface and the refraction due to the phase velocity increasing with height, and the effect of the microphone response. Corrections are derived for finite amplitude effects and refraction under a constant gradient for sound speed and wind speed. Recommendations for experimental studies to confirm this theoretical work are included. GRA

N80-11875# Lund Inst. of Tech. (Sweden). Dept. of Building Acoustics.

ON THE USE OF FINITE ELEMENT METHOD ON SOME ACOUSTICAL PROBLEMS

Leif Cederfelt 1979 95 p refs Original contains color illustrations

(Grant SWEDCBR-740095-5)

(D4-1979; ISBN-91-540-3009-9) Avail: NTIS HC A05/MF A01

The finite element method application on some acoustical problems is discussed in order to show the possibilities of the method. A brief description of the element formulation for air and beam elements is given and the technique of how to take boundary conditions into consideration and how internal losses are regarded is considered. The coupled beam-air system solution is made by iteration between two equation systems, one for the air and one for the beam elements. Applications such as sound attenuation of a right angle bend, a lined duct and an expansion chamber are described. The finite element method is also discussed in terms of costs and limitations. The method has its power for small geometries or low frequencies, that is, when analytical methods are usually weak. The more complex the geometry of a studied problem is, the more powerful the finite element method seems to be. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-11876# Nagoya Univ. (Japan). Inst. of Plasma Physics.

SINGLE-ELECTRON CAPTURE INTO Ar + EXCITED STATES IN Ar + Ne COLLISION BELOW 12 keV. 2: RELATIVE POPULATION DISTRIBUTED IN Ar + EXCITED STATES

Atsushi Matsumoto, Seiji Tsurubuchi, Kazuhiko Okuno, Shunsuke Ohtani, Tsuruji Iwai, and Yozaburo Kaneko Aug. 1979 29 p refs Sponsored by the Min. of Educ.

(IPPJ-411) Avail: NTIS HC A03/MF A01

Excitation cross-sections are obtained for each term of the ArII nl-states (nl = 4p, 4p' and 4d) at 4 and 8 keV. The relative population distribution among the terms of a given nl-state can be interpreted in terms of statistics based on the building-up

principle of molecule under radial coupling scheme. The relative population distribution among the multiplets in a given term is proportional to their statistical weight; spin-orbit recoupling at large internuclear separations is responsible for the population mechanism. The energy dependence of excitation cross-sections is discussed in connection with the Landau-Zener theory. Author

N80-11877# Naval Research Lab., Washington, D. C.
SPACE CHARGE LIMITED TRANSPORT AND BUNCHING OF NON K-V BEAMS
I. Haber 25 Jul. 1979 12 p refs
(AD-A072417; NRL-MR-4050) Avail: NTIS HC A02/MF A01 CSCL 20/8

Particle simulations are used to examine the behavior of an intense beam propagating down an alternate gradient focusing channel. In order to examine the dependence of emittance growth on the particle distribution function, an initially low current, non K-V, matched distribution is established. The current is then slowly increased as the beam propagates down the channel. Differences are observed in both the current at which emittance growth begins, and the rate at which the emittance grows, when the form of the initial distribution is changed. But this emittance growth still limits the intensity of the beam being transported. GRA

N80-11878# IBM Research Lab., San Jose, Calif.
ATOMIC AND MOLECULAR INTERACTION THEORY Final Report, Jun. 1978 - May 1979
R. K. Nesbet Jul. 1979 26 p refs
(Contract N00014-78-C-0447)
(AD-A072124) Avail: NTIS HC A03/MF A01 CSCL 20/10

New methods were used in theoretical studies on the dynamical development of final state populations in atom-molecule reactive collisions. Quantitative calculations of the H-H2 exchange reaction showed that information theory predicts rotational distributions far from equilibrium. A new theory of vibration excitation in electron-molecule scattering was devised. Accurate (1%) cross sections for e(-) He scattering below 19 eV were computed variationally. GRA

N80-11879# SRI International Corp., Menlo Park, Calif. Molecular Physics Lab.
ION PHOTOFRAGMENT SPECTROSCOPY: POTENTIAL SURFACES OF MOLECULAR IONS Final Report, 16 May 1978 - 15 May 1979
J. T. Moseley, P. C. Cosby, and J. R. Peterson 2 Jul. 1979 97 p refs
(Contract F44620-76-C-0095; AF Proj. 2303; SRI Proj. 5495)
(AD-A073000; SRI-MP-79-49; AFOSR-79-0943TR) Avail: NTIS HC A05/MF A01 CSCL 07/4

Techniques of ion photofragment spectroscopy have been used to investigate the structure and dissociation of molecular ions. For this research, a unique laser-ion coaxial beams spectrometer was constructed, allowing substantially improved sensitivity and resolution. The rare gas dimer ions were studied in detail, resulting in the determination of potential curves, absorption and photodissociation cross sections, and photofragment angular distributions for these ions. Effects from spin-orbit coupling were found to be very important. The predissociation of the positive and negative ozone ions were investigated to obtain structural information about these ions. Very high resolution spectroscopy of the quartet states of the positive oxygen ion allowed a substantial improvement in these potential curves, as well as an improved determination of the bond dissociation energy of neutral oxygen. Photofragment spectroscopy of the positive ion of CH led to the observation of two predissociations, one in the singlet and one in the triplet system. Similar measurements on the positive ion of methyl iodide led to the resolution of rotational and fine structure levels in the previously observed predissociation of this ion. GRA

N80-11880# California Univ., Berkeley. Lawrence Berkeley Lab.
STUDY BY ELASTIC THEORY OF THE CLUSTERING OF SOLUTE ATOMS DURING THE EARLY STAGE OF SOLID SOLUTION DECOMPOSITION Ph.D. Thesis
Minghwai Hong Sep. 1978 75 p refs
(Contract W-7405-eng-48)
(LBL-7880) Avail: NTIS HC A04/MF A01

An expression for the elastic strain energy of a coherent inclusion of arbitrary shape in an anisotropic medium is derived from both macroscopic theoretical approaches. This expression is simplified for the case of a very thin disk shape inclusion. A method which takes the thickness effects into account developed in order to calculate minimum strain energy orientation of the disk shaped nitride precipitate in iron-nitrogen martensite. DOE

N80-11881# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. Development Div.
THE C-13 STUDY OF THE POTENTIAL INFLUENCE OF THERMAL AGING ON THE MOLECULAR INTEGRITY OF FEFO
G. L. Clink Aug. 1978 9 p
(Contract EY-76-C-04-0487)
(MHSMP-78-32) Avail: NTIS HC A02/MF A01

A C-13 nuclear magnetic resonance study of isothermally aged FEFO is examined for molecular instability in the materials. A C-13 analysis of acetone extracts of thermally aged LX-09 is discussed. A.W.H.

N80-11882# McElroy (Ralph) Co., Austin, Tex.
ISOTOPE SEPARATION BY LASER-INDUCED PHOTOMIGRATION
K. Wada 1978 19 p refs Transl. into ENGLISH from Reza Kenkyu (Japan), v. 4, no. 3, 1976 p 225-233 Prepared for LASL
(Contract W-7405-eng-36)
(LA-TR-78-36) Avail: NTIS HC A02/MF A01

A gas mixture of 1:100 BCl3 and Xe is blown against a cold plate to form a solid film. This sample is irradiated by a cw CO2 laser. After several hours of irradiation, it is found from infrared spectra that (B-11)Cl3 molecules are excited selectively and are educed on the cold plate as fine crystals. This phenomenon is considered to be due to laser-induced migration of (B-11)Cl3 molecules through Xe matrix. As Xe sublimates, (B-10)Cl3 molecules are released from the cold plate so that (B-11)Cl3 is enriched on the plate. The value of the separation factor obtained with 3.3 watt laser radiation is estimated to be 8.4. DOE

N80-11883# Minnesota Univ., Minneapolis. Dept. of Chemistry.
MOLECULAR BEAM STUDIES OF ION-MOLECULE REACTIONS
W. R. Gentry 1978 23 p refs Presented at NATO Inst. on Ion-mol. Reactions, La Boule, France, 4 Sep. 1978
(Contract EY-76-S-02-2640)
(COO-2640-8; Conf-780931-4) Avail: NTIS HC A02/MF A01

The areas in which molecular beam techniques contribute to the understanding of ion-molecule reaction dynamics are reviewed. Included are reactant kinetic energy range and resolution, internal state selection and analysis, and chemical systems and phenomena. DOE

N80-11884# Washington Univ., Seattle. Dept. of Chemistry.
HIGH TEMPERATURE GAS ENERGY TRANSFER Annual Summary Report, 1 Aug. 1978 - 31 Jul. 1979
B. S. Rabinovitch 7 Aug. 1979 9 p refs
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A072727) Avail: NTIS HC A02/MF A01 CSCL 07/4

Work under this contract is summarized. Results on collisional transfer of vibrational energy of gases and temperature dependence of transfer efficiency by the Diffusion Cloud method are described. New results by a novel and simple Variable Encounter Method for the study of vibrational energy transfer between gas molecules and a wall, at high temperatures and levels of activation, in the transient region are reported; cyclopropane and cyclobutane have been studied. GRA

N80-11885# Montpellier Univ. (France). Dept. de Physique Mathematique.
ON THE COMPUTATION OF BOUNDS FOR LOW ENERGY COMPTON SCATTERING PARAMETERS: PROOF OF A CONJECTURE
G. Auberson and G. Mennessier 1979 16 p refs

(PM/79/7) Avail: NTIS HC A02/MF A01

A proof showing that the outer approximation results of a method proposed by Raszillier gives the optimal bounds for low energy scattering parameters as functions of the fixed transfer cross sections above the photoproduction threshold is shown. The Raszillier method was proposed to solve an extremum problem which arises in the derivation of dispersion inequalities for Compton scattering. A reduced mathematical form of the problem is stated after suitable changes of function (amplitudes) and conformal mapping of the energy plane. The proof is reached by making use of duality formulas in order to avoid the difficulties of dealing with spaces of analytical functions. Author (ESA)

N80-11886# Montpellier Univ. (France). Dept. de Physique Mathematique.

TESTS OF STRONG, ELECTROMAGNETIC INTERACTIONS AND WEAK INTERACTIONS WITH POSITRON ELECTRON COLLISIONS

F. M. Renard Mar. 1979 62 p refs Presented at 10th Spring Symp. on High Energy Phys., Bermsgruen, East Ger.
(PM/79/8) Avail: NTIS HC A04/MF A01

The use of electron-positron collisions for testing quantum electrodynamic hypothesis and for stuyding electromagnetic hadron structure is reviewed. The applications discussed include studies about the total cross section of hadron-forming electron-positron collisions, vector mesons, light u and d quarks, strange quarks, charm quarks, bottom quarks, the search for heavier quarks, multiparticle production of quark and gluon jets, the phenomenological parton jet model, and electromagnetic as well as weak interactions at high energy. Author (ESA)

N80-11887# Montpellier Univ. (France). Dept. de Physique Mathematique.

DIRECT PHOTON EMISSION IN POSITRON ELECTRON ANNIHILATION PROCESSES

F. M. Renard Apr. 1979 12 p refs Presented at ECFA-LEP Working Group Meeting, Hamburg, 4-6 Apr. 1979
(PM/79/9) Avail: NTIS HC A02/MF A01

The reactions electron positron yields gamma + anything at very high energy are reviewed. The QED processes and their possible modifications by weak interactions are considered. The production of weak bosons is studied and their interest for testing the Yang-Mills couplings and checking the absence of any anomalous other couplings is shown. The case of electron positron yields gamma + hadrons is treated; the two processes: (1) radiation from initial spectral lines depending on the cross-section for electron positron yields hadrons at lower energies, and (2) central photon emission gamma or zeta yields gamma + hadrons expressed in terms of photon structure functions are examined. Their 'Born terms' are calculated, their interest for testing quark quantum numbers (charge, color) is noted. The possible use of photon spectra to search for exotic particles is also discussed. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-11888# California Univ., Livermore. Lawrence Livermore Lab.

LIMITATIONS TO THE USE OF TWO-DIMENSIONAL THERMAL MODELING OF A NUCLEAR WASTE REPOSITORY

B. W. Davis 4 Jan. 1979 41 p refs
(Contract W-7405-eng-48)
(UCID-18101) Avail: NTIS HC A03/MF A01

Recent modeling studies show that the time-dependent temperature distribution of the waste emplacement media can be accurately modeled in the far-field using a 2-dimensional (2-D) planar numerical model; however, the near-field cannot be modeled accurately enough by either 2-D axisymmetric or 2-D planar numerical models for repositories in salt. The accuracy limits of 2-D modeling were defined by comparing results from 3-dimensional (3-D) TRUMP modeling with results from both 2-D Axisymmetric and 2-D planar. Both TRUMP and ADINAT were employed as modeling tools. Two-dimensional results from the finite element code, ADINAT were compared with 2-D results from the finite difference code, TRUMP; they showed almost perfect correspondence in the far-field. This result adds substantially to confidence in future use of ADINAT and its companion stress code ADINA for thermal stress analysis ADINAT was found to be somewhat sensitive to time step and mesh aspect ratio. DOE

N80-11889# Los Alamos Scientific Lab., N. Mex.

GENERAL-PURPOSE HEAT SOURCE PROJECT SPACE NUCLEAR SAFETY PROGRAM AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report

R. D. Baker, comp. Sep. 1978 55 p
(Contract W-7405-eng-36)
(LA-7519-PR) Avail: NTIS HC A04/MF A01

Studies related to the use of (Pu-238)O2 in radioisotopic power systems are reported. DOE

N80-11890# Brookhaven National Lab., Upton, N. Y.

INFORMAL CONFERENCE ON STATUS AND FUTURE OF SOLAR NEUTRINO RESEARCH; PROCEEDINGS

Gerhart Friedlander, ed. 1978 272 p refs Conf. held in Upton, N.Y., 5-7 Jan. 1978
(Contract EY-76-C-02-0016)
(BNL-50879-Vol-2; Conf-780117-P2-Vol-2) Avail: NTIS HC A12/MF A01

Possible electronic methods and new theoretical approaches to the study of solar neutrinos are discussed in twelve papers. Topics covered include solar distortion; the possibility of a changing gravitational constant and of mixing in stars; the rotational history of the sun; nonradial oscillations of the nonstandard solar model; neutrino oscillations; and a critique of the chlorine-37 experiment. The round table discussion addressed the astronomical and cosmological implications of the various nonstandard models, future programs in laboratory experiments and theoretical calculations on reaction cross sections, opacities, convections, and observations of elemental abundances on the sun and the meteorites, and lastly the program in solar neutrino research. DOE

N80-11891# Technical Research Centre of Finland, Espoo.

EVALUATION OF NUCLEAR POWER PLANT SITING BY PROBABILISTIC ASSESSMENT OF ENVIRONMENTAL IMPACT Ph.D. Thesis - Helsinki Univ., Otaniemi, Finland

Seppo Vuori 1978 20 p refs
(VTT-EN-24; ISBN-951-38-0704-5) Avail: NTIS HC A02/MF A01

A probabilistic consequence assessment model ARANO and the individual calculation schemes therein included are described. This assessment model was applied to the risk/benefit and cost/benefit analyses of the siting of nuclear power plants. In addition, some comparisons with alternative fossil-fuelled energy production scenarios are made. Results indicate the model gives useful data in these applications. Author (ESA)

74 OPTICS

Includes light phenomena.

N80-11892*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

WIDE ANGLE OPTICAL SYSTEMS Patent Application

Fred Vicik, inventor (to NASA) (Barnes Engineering Co., Stamford, Conn.) Filed 19 Oct. 1979 12 p Sponsored by NASA
(NASA-Case-MSC-18373-1; US-Patent-Appl-SN-86508) Avail: NTIS HC A02/MF A01 CSCL 20F

A wide angle optical field flattening system for a multispectral scanner is described which provides a large field angles and high resolution at low f-numbers. The system utilizes a basic optical element in the form of a first flat surface of a reflecting element which directs a ray bundle to a second sperical reflection surface. The second spherical reflection surface reflects the bundle

to a field flattener coating on a third spherical surface located intermediate of the first flat surface and the second spherical surface. The third spherical surface forms an exit ray bundle on a flattened image plane with a lower f-number than that reflected from the field flattener coating. The exit ray bundle is passed through a coating to the image plane and to a sensing or scanning surface. NASA

N80-11892# New Mexico State Univ., Las Cruces. Dept. of Electrical and Computer Engineering.
REAL-TIME VIDEO TRACKING CONCEPTS Final Report
G. M. Flachs, P. I. Perez, R. B. Rogers, S. J. Szymanski, and J. M. Taylor Jun. 1979 46 p refs
(Grant DAAG29-76-G-0231)
(AD-A071792; NMSU-TR-79-1; ARO-13857.4-EL) Avail: NTIS HC A03/MF A01 CSCL 17/8

Real-time video (RTV) tracking concepts are developed for tracking high performance targets in noisy background scenes. Image processing techniques are combined with parallel processing methods to perform a statistical analysis of a TV image, partition the picture into target and background components, perform a structural analysis of the target image, and control the tracking optics to form an automatic tracking system. GRA

N80-11894# Maryland Univ., College Park. Computer Science Center.
STRIP DETECTION USING RELAXATION
Alan Danker and Azriel Rosenfeld Jan. 1979 14 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A071606; TR-725) Avail: NTIS HC A02/MF A01 CSCL 17/8

This note describes some experiments in the detection of parallel sided strips using a relaxation-like process which iteratively reinforces collinear or anti-parallel edges. The process was tested on two types of data, tree trunks and runways. GRA

N80-11895# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.
INFRARED ABSORPTION BY WATER CLUSTERS Final Report, Aug. 1976 - Sep. 1978
Hugh R. Carlon Mar. 1979 47 p refs
(AD-A071455; AD-E410129; ARCSL-TR-79013) Avail: NTIS HC A03/MF A01 CSCL 20/6

This report summarizes the results of a two-year study of atmospheric infrared 'continuum' absorption attributed to intermolecularly bonded clusters in water vapor. Spectral data are reviewed for water vapor, steam and liquid water. The infrared continuum absorption is discussed in detail and is shown to be explicable on the basis of homogeneous or ion-induced cluster distributions in water vapor, where the cluster population is approximately proportional to the square of the partial water vapor pressure. Thermodynamic consistency between the vapor and liquid phases is discussed for temperatures including the critical (374 C) where the phases become one. Simple oscillator models are shown to give agreement with observed spectral lines, suggesting certain cluster configurations. The ion concentration of moist air versus temperature is discussed, and measurements of ion cluster distributions are considered. Cluster absorption at longer wavelengths including the microwave region is discussed. Conclusions are presented. GRA

N80-11896# Florida Technological Univ., Orlando. Dept. of Electrical and Computer Engineering.
INVESTIGATION OF A MULTIMODE FIBER OPTIC COUPLER Final Report, 1 Apr. - 31 Dec. 1978
Marvin D. Drake 1979 50 p refs
(Grant AF-AFOSR-3566-78; AF Proj. 2305)
(AD-A071874; AFOSR-79-0859TR) Avail: NTIS HC A04/MF A01 CSCL 20/6

The operation of a three-fiber multimode fiber optic coupler was experimentally investigated for the dependence of the forward coupling ratio upon surface conditions of the aligning rods, stress on the fibers, length of the aligning rods, mode distribution in the main fiber, make of fiber, and length of input fiber. An explanation of the discrepancies between theory and experiment was also sought. The forward coupling was found to increase for gross perturbations of the surface of the alignment rods, increase for increased stress on the fibers, increase with length of the aligning rods, increase with increasing number of higher order modes, depend strongly on type of fiber, and decrease with input fiber length. Further, the directivity of the coupler was increased greatly by reducing reflections from the ends of the fibers. GRA

N80-11897# University of Southern California, Los Angeles.
WAVEGUIDE STUDIES FOR FIBER OPTIC SOURCES Interim Report
Elsa Garmire Griffiss AFB, N. Y. RADC Jun. 1979 69 p refs
(Contract F19628-77-C-0221; AF Proj. 2306)
(AD-A071446; RADC-TR-79-112) Avail: NTIS HC A04/MF A01 CSCL 20/6

Methods for multimode optical beam expansion, deflection, and switching are discussed in connection with fiber optic and optical signal processing applications. The feasibility of using negative waveguide lenses as beam expanders for stripe-geometry lasers is demonstrated. A monolithically integrated laser source and beam expander is designed utilizing planar epitaxy and selective chemical etches. Epilayer designs for optical coupling of light from the laser region to the waveguide are discussed. Grating distributed Bragg deflectors are fabricated, and the beam expansion from them is characterized. The use of electrical feedback is produce bistability in an optical switch in both bulk LiNbO3 and LiNbO3 waveguides is demonstrated, and the transient response of these hybrid bistable optical devices is investigated. Theoretical predictions of the dependence of switching time on applied light increment are confirmed. GRA

N80-11898# TRW Defense and Space Systems Group, Redondo Beach, Calif.
FIBER OPTIC DETECTION OF LOW FREQUENCY UNDERWATER SOUND Final Report, 4 Jan. 1978 - 30 Apr. 1979
D. W. Baggett and R. L. Johnson 28 Jun. 1979 32 p refs
(Contract N00014-76-C-0490; NR Proj. 089-117)
(AD-A072829; TRW-AT-ATD-TR-79-2) Avail: NTIS HC A03/MF A01 CSCL 17/1

Theoretical and experimental studies of acousto-optic interferometry were continued. An experimental test of the differential loop interferometer demonstrated that the theoretical sensitivity limit can be achieved with acoustic frequencies from 1 kHz to 50 kHz. The Michelson interferometer was studied under an environmentally stabilized configuration, but the theoretically sensitivity limit was not achieved. A Fabry-Perot configuration was analyzed, giving a theoretical prediction of very high sensitivity per unit fiber length. GRA

N80-11899# Sandia Labs., Albuquerque, N. Mex.
RADIATION EFFECTS IN OPTICAL EMITTERS AND RECEIVERS
C. E. Barnes and K. W. Mitchell 1978 7 p refs Presented at Fiber Optics and Communications Exposition, Chicago, 6 Sep. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1798; Conf-780923-2) Avail: NTIS HC A02/MF A01

Radiation damage to the emitter and detector components of optoelectronic systems was studied. Results are summarized for light-emitting diodes, laser diodes, semiconductor detectors, and optical isolators. DOE

N80-11900# California Univ., Livermore. Lawrence Livermore Lab.
FRESNEL ZONE CORRECTION PLATES FOR THE ELECTRON MICROSCOPE
W. Hoppe Dec. 1978 12 p refs Transl. into ENGLISH from Optik, vol. 20, no. 12, 1963 p 599-606 Transl. by Addis Translation Intern., Portola Valley, Calif.
(UCRL-Trans-11440) Avail: NTIS HC A02/MF A01

A correction element for correction of the spherical aberration of rotationally symmetric electron lenses is described. It consists of circular annular diaphragms which block off those zones of the image-side wave from which elementary waves arrive at the image point in phase opposition. DOE

N80-11901# Ecole Nationale Superieure des Telecommunications, Paris (France). Lab. Image.
[ACTIVITIES REPORT OF THE IMAGE LABORATORY] Annual Report, 1976 [COMPTE-RENDU D'ACTIVITE]
Jan. 1979 39 p refs In FRENCH; ENGLISH summary
(ENST-D-79005) Avail: NTIS HC A03/MF A01

Hybrid numerical, optical, and video image processing is reported. Research projects include image modelization aimed at describing stationary zones (textures) and nonstationary characteristics (contours). This theoretical study was applied to television and visiophone pictures as well as to numerical image processing (contour detection algorithms). Image pattern recognition work comprised the optimization of optical filtering methods. This technique was implemented numerically and a machine was tested for the blind. As examples of numerical synthesis of optical filters and numerical analysis of optical processing, biomedical applications and scene analysis through complex filtering are cited. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-11902# *Nagoya Univ. (Japan). Inst. of Plasma Physics.*
BALLOONING BETA LIMIT OF A NON-CIRCULAR SMALL-ASPECT-RATIO TOKAMAK
K. Yamazaki Aug. 1979 27 p refs
(IPPJ-413) Avail: NTIS HC A03/MF A01

The influence of the cross sectional shape of the plasma with rather small aspect ratio on the infinite mode number ballooning stability is discussed and the related critical beta value is determined. The Soloviev equilibrium model with quasi uniform current is adopted in the discussion. The equilibrium model and the reduced ordinary differential equation for linear ballooning modes on each magnetic surface is described. The dependences of the aspect ratio, ellipticity, and triangularity on the beta limitation due to the ideal linear ballooning instability are examined. A.W.H.

N80-11903# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RELAXATION OF Z DISCHARGE BETWEEN ELECTRODES
K. Ikuta Aug. 1979 11 p refs
IPPJ-414) Avail: NTIS HC A02/MF A01

The application to of Taylor's theory to zeta discharged plasma with finite length, which is determined by electrodes made of good conductor, is described. The problem of the impurity ejection from the electrode surfaces until the burn condition of fuel plasma is attained is addressed. The application of the zeta discharge to thermonuclear purposes is examined. The existence of a helical state in the zeta discharge is discussed and the formation of a toroidal configuration by an intense zeta discharge in a casing is considered. A.W.H.

N80-11904# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A STUDY OF REVERSED FIELD PINCH EXPERIMENTS USING A NEW PROGRAMMING MODE
Y. Kita Aug. 1979 44 p refs
(IPPJ-415) Avail: NTIS HC A03/MF A01

A mode of external field programming for setting up a reversed field pinch (RFP) is tested. An initial plasma with a screw pinch followed by external field reversal is created. The program is described and the equilibrium relation with respect to the minor radius throughout the setting up phase is examined. A one dimensional stability analysis based on an ideal MHD model is applied to the experimental results. The instability which is m = 1 resistive tearing mode under the influence of viscosity, is discussed. High current operation at 110 kA using the new programming is evaluated. A.W.H.

N80-11905# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DIRECT COMPARISON BETWEEN CIRCULARLY AND LINEARLY POLARIZED RF FIELD IN ICRF HEATING OF A TOROIDAL PLASMA
Yasuyoshi Yasaka and Ryohei Itatani Aug. 1979 34 p refs
(IPPJ-416) Avail: NTIS HC A03/MF A01

ICRF heating of a toroidal plasma is performed using slow waves generated by the m = +1 circularly polarized rf field and the m = + or - 1 linearly polarized rf field which is, in general, conventionally employed. From direct comparison between the two field-modes on wave generation, ion heating efficiency, and enhanced plasma loss, it is revealed that the circularly polarized field is far more effective than the linearly polarized field in both achieving higher heating efficiency and reducing enhanced plasma loss. The ion heating by the linearly polarized field is accompanied with the enhanced cross-field plasma loss, which may be qualitatively explained by the ion convection resulting from the ponderomotive force of the applied RF field. Author

N80-11906*# United Technologies Research Center, East Hartford, Conn.
ARGON/UF6 PLASMA EXHAUST GAS RECONSTITUTION EXPERIMENTS USING PREHEATED FLUORINE AND ON-LINE DIAGNOSTICS
Ward C. Roman Oct. 1979 79 p refs
(Contract NAS1-14329)
(NASA-CR-159158) Avail: NTIS HC A05/MF A01 CSCL 20I

The feasibility of employing a flowing, high-temperature, pure fluorine/UF6 regeneration system to efficiently convert a large fraction of the effluent plasma exhaust back to pure UF6 was demonstrated. The custom built T.O.F. mass spectrometer sampling system permitted on-line measurements of the UF6 concentration at different locations in the exhaust system. Negligible amounts (< 100 ppm) of UF6 were detected in the axial bypass exhaust duct and the exhaust ducts downstream of the cryogenic trap system used to collect the UF6, thus verifying the overall system efficiency over a range of operating conditions. Use of a porous Monel duct as part of the exhaust duct system, including provision for injection of pure fluorine, provided a viable technique to eliminate uranium compound residue on the inside surface of the exhaust ducts. Typical uranium compound mass deposition per unit area of duct was 2 micron g/sq cm. This porous duct technique is directly applicable to future uranium compound transfer exhaust systems. Throughout these experiments, additional basic data on the corrosion aspects of hot, pressurized UF6/fluorine were also accumulated. A.R.H.

N80-11907# Naval Research Lab., Washington, D. C.
THE OSCILLATING TWO STREAM AND PARAMETRIC DECAY INSTABILITIES IN A WEAKLY MAGNETIZED PLASMA
H. P. Freund and K. Papadopoulos 23 Jul. 1979 33 p refs
(AD-A072396; NRL-MR-4042) Avail: NTIS HC A03/MF A01 CSCL 20/9

We consider the effects of a weak ambient magnetic field on the oscillating two stream and parametric decay instabilities, with particular emphasis on the dependence on the angular variation of the instability thresholds and growth rates on the magnetic field. A dispersion relation is derived in the limit in which omega sub e > Omega sub e (where omega sub e and Omega sub e are the electron plasma and cyclotron frequencies respectively), and is solved for dipole and monochromatic pump spectra. The analysis shows that the presence of a magnetic field can substantially enhance thresholds and reduce growth rates for waves propagating at an oblique angle with respect to the magnetic field and (k lambda sub e)-squared approximately = (Omega sub e/omega sub e)-squared (where k is the wavevector of the perturbation and lambda sub e the Debye length). Thus, the magnetic field has a stabilizing influence on the off-parallel propagating modes. GRA

N80-11908# California Univ., Livermore. Lawrence Livermore Lab.
MAGNETIC MIRROR FUSION RESEARCH AT THE LAWRENCE LIVERMORE LABORATORY
R. F. Post 9 Feb. 1979 25 p Presented at the All-Union Conf. on Controlled Fusion, Moscow, 21-27 Feb. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-82318; Conf-790232-1) Avail: NTIS HC A02/MF A01

Success in achieving workable solutions to the scientific

problems of plasma equilibrium and plasma instability and to technical problems of creating and sustaining fusion plasma in mirror systems is reviewed. The economic problem of improving the power amplification factor, Q, of a fusion system using magnetic mirrors is addressed. Possible solutions examined include the use of tandem mirrors and field reversal using high level current neutral beam injection. A.R.H.

N80-11909# Los Alamos Scientific Lab., N. Mex.
STABILITY THEORY FOR INTERNAL RING CONFIGURATIONS
Guthrie Miller Jan. 1979 13 p refs
(Contract W-7405-eng-36)
(LA-7618-MS) Avail: NTIS HC A02/MF A01

The magnetohydrodynamics stability theory of internal ring configurations is developed using nearly cylindrical, sharp-boundary plasma model. DOE

N80-11910# Illinois Univ., Urbana. Fusion Studies Lab.
STABILITY OF FIELD REVERSED MIRRORS
E. C. Morse, W. C. Condit (Lawrence Livermore Lab.), and G. H. Miley 1978 3 p refs Presented at ANS Meeting, Washington, D. C., 12 Nov. 1978
(Contract EY-76-S-02-2218)
(COO-2218-119; Conf-781105-79) HC A02/MF A01

An energy principle is used to demonstrate stability of low frequency modes and derive limiting conditions of importance to design stability studies such as SAFFIRE. DOE

N80-11911# Oak Ridge National Lab., Tenn.
LONG PULSE TECHNOLOGY TOKAMAK
T. C. Jernigan 1978 10 p refs Presented at the Meeting on the Eng. of Large Tokamak Experiments, Paris, 1 Sep. 1978
(Contract W-7405-eng-26)
(CONF-780966) Avail: NTIS HC A02/MF A01

The long pulse technology Tokamak, a noncircular Tokamak, is described for extended pulse operation at high beta and reactor level wall power loading. The toroidal field coils are superconducting and a superconducting bundle divertor is discussed for active impurity control. Experimental access and flexibility in operation are discussed. DOE

N80-11912# Minnesota Univ., Minneapolis. Dept. of Physics and Astronomy.
THEORETICAL AND HIGH ENERGY PHYSICS Progress Report, 1977 - 1978
1978 39 p refs
(Contract EY-76-C-02-1764)
(COO-1764-342) Avail: NTIS HC A03/MF A01

Generalization of the spherical harmonic gradient formula, nuclear many body problems, and effective operators in the shell model are among the topics covered in this review of research into elementary particle theory and high energy interactions. Experiments being conducted relate to elastic scattering; depolarization, p-He (4) scattering; direct electron production; pn polarization at 2.3 and 6 GeV/c; low energy polarization; and coherent production. A.R.H.

N80-11913# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Freiburg (West Germany). Inst. fuer Physikalische Weltraumforschung.
DENSITY FLUCTUATIONS IN A PLASMA CHAMBER Final Report
Rainer Kist, Surya P. Gupta, Heinz Thiemann, and Wolfgang Kampe Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 99 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1076; DFVLR-BPT-01-QV-296)
(BMFT-FB-W-77-48) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 20.60

Density fluctuations in a large plasma chamber were investigated and first results obtained are described. The investigations covered density fluctuations in the undisturbed plasma beam with and without external magnetic field and for different beam energies, density fluctuations produced by extracting as well as injecting electron currents (beam-plasma-interaction) in connection with the production of electric fields parallel to B (electric double layers), and density fluctuations in the wake of a sphere in view of the role of the wake dynamics for plasma investigations on Spacelab. The resonance cone in the real magnetoplasma was also studied and results are used in the development of an improved kinetic resonance cone theory. Author (ESA)

N80-11914# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
CONTINUOUS DOUBLE ADIABATIC SPECTRUM IN A PLASMA CONFINED IN A POLOIDAL MAGNETIC FIELD Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
T. Hellsten Feb. 1979 18 p refs Sponsored by EURATOM
(TRITA-PFU-79-02) Avail: NTIS HC A02/MF A01

The continuous spectrum of an anisotropic toroidal plasma confined in a poloidal magnetic field is investigated with the double adiabetic theory. The continuous spectrum is given by an eigenvalue problem of two uncoupled second order ordinary differential equations. Results show that in contrast to the magnetohydrodynamic continuum the double adiabetic continuum may become unstable. The stability depends upon the perpendicular and parallel pressure distributions along the field lines. Author (ESA)

N80-11915# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
MEASUREMENTS OF ELECTRON DENSITY AND TEMPERATURE PROFILES IN A GAS BLANKET EXPERIMENT Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
A. Kuthy Feb. 1979 28 p refs Sponsored by EURATOM
(TRITA-PFU-79-03) Avail: NTIS HC A03/MF A01

Radial profiles of electron density, temperature, and H beta intensity are presented for the rotating plasma device F-1. The hydrogen filling pressure, the average magnetic field strength at the midplane, and the power input to the discharge were varied in the ranges 10 to 100 mTorr, 0.25 to 0.5 Tesla, and 0.1 to 1.5 MW, respectively. These experiments were performed in order to study the gas blanket (cold-mantle) state of the plasma. It is shown that a simple spectroscopic method can be used to derive the radial distribution of the electron temperature in such plasmas. The observed peak temperatures and densities are in agreement with earlier theoretical estimates. Author (ESA)

N80-11916# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
RESONANCE AND CUT-OFF SURFACES IN THE ION CYCLOTRON FREQUENCY RANGE IN TOROIDAL GEOMETRY Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
T. Hellsten and E. Tennfors Mar. 1979 19 p refs Sponsored by EURATOM
(TRITA-PFU-79-04) Avail: NTIS HC A02/MF A01

Resonances and cut-offs of the fast Alfven and ion-cyclotron waves were studied for a multicomponent plasma in a toroidal axisymmetric geometry. The resonance and cut-off frequencies are given by eigenvalues of ordinary differential equations on the resonance and cut-off surfaces, respectively. These surfaces coincide with magnetic surfaces. Author (ESA)

N80-11917# Pisa Univ. (Italy). Fac. di Ingegneria.
ON THE BALANCE EQUATION FOR ANGULAR MOMENTUM IN A PLASMA [L'EQUAZIONE DI BILANCIO DEL MOMENTO DELLE QUANTITA' DI MOTO IN MECCANICA DEI PLASMI]
Giulio Mattei 1978 5 p refs In ITALIAN; ENGLISH summary
Presented at 4th Cong. Nazl. di Meccan. Teorica ed Appl., Florence, 25-28 Oct. 1978
(Rept-1670) Avail: NTIS HC A02/MF A01

The balance equation for angular momentum in a plasma described by the magnetohydrodynamic model is obtained. The equation is derived as a consequence of four factors. These are: (1) the related equation of continuity, (2) the equation of motion, (3) the symmetry of the mechanical stress tensor in the plasma, and (4) the fact that the electromagnetic force per unit volume in the plasma can be expressed as the divergence of a symmetric tensor, i.e. the Maxwell magnetic stress tensor in the plasma. Author (ESA)

N80-11918# Uppsala Univ. (Sweden). Dept. of Theoretical Electronics.

ON THE EXISTENCE AND STABILITY OF TRAPPED LANGMUIR MODES IN A DOUBLE LAYER

Christer Wahlberg Nov. 1978 46 p refs Sponsored by Swed. Nat. Sci. Res. Council Submitted for publication

(UPTEC-78-89-R) Avail: NTIS HC A03/MF A01

The stability problem of the double layer (electrostatic shock) is investigated using a simple model of the plasma. It is shown that local Penrose stability in general is insufficient for global stability due to the existence of linearly unstable trapped Langmuir modes in the density cavity. An additional requirement for stability is that the thickness of the layer must be smaller than a critical value, which in the case of a strong layer, and for the particular model being used, is shown. Various qualitative features of the instability mechanism are discussed in terms of normal mode coupling and quantitative results such as mode frequencies, growth rates, etc., are obtained by means of a conventional perturbation approach which in addition to the results expected from coupled mode theory also shows the existence of two purely decaying modes appearing for a sufficiently thin, stable layer. The double layer formation process is briefly commented on and some distinguishing features of the instability in this regard are pointed out. Author (ESA)

N80-11919# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).

PARAMETER CALCULATION OF A SCREW-PINCH REACTOR WITH ELONGATED CROSS-SECTION

J. A. Hoekzema and W. Schuurman Apr. 1979 37 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (SWO) and EURATOM

(Rept-79-117) Avail: NTIS HC A03/MF A01

In continuation of systems on screw-pinch reactors with a circular cross section, a parameter calculation was performed for a similar reactor with a chamber of rectangular shape. The duty cycle of the reactor comprises an implosion heating phase, an adiatatic compression of the plasma up to the ignition temperature, a phase of thermonuclear burn maintained by generated alpha particles, and a down-time for plasma cooling, pumping, and refuelling. Starting with a set of parameters that are mainly determined by expected technical limitatons, a zero dimensional, time dependent computer code is used to describe the various stages of the duty cycle. The physical model and the numerical method for this parameter calculation are described. It is found that severe ohmic losses limit the net efficiency to 20%. Therefore, it must be concluded that a screw-pinch reactor based on the assumptions of plasma heating by fast implosion and subsequent adiabatic compression, the use of resistive coils, an actively controlled value of beta and omittance of fuel injection, is not economically feasible. Author (ESA)

N80-11920# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).

PROGRESS IN RINGBOOK 2, TORTUR 2 AND SPICA 2 FOR 1978 Annual Status Report, December 31, 1978

Apr. 1978 82 p refs Sponsored in part by EURATOM and Neth. Organ. for Pure Sci. Res. (ZWO)

Avail: NTIS HC A05/MF A01

Three plasma confinement experiments, RINGBOOG 2, TORTUR 2, and SPICA 2, are reported. The SPICA 2 design is evaluated in order to minimize stray magnetic fields and mechanical forces resulting from the gaps in the copper shell. An experiment is described which shows that the confinement of the heated plasma is affected by an influx of neutrals from the wall. The RINGBOOG 2 experiment is discussed. RINGBOOG 2 operates in the well established, high density, low temperature RINGBOOG 1 regime, under normal Tokamak operating conditions and in an intermediate, high density Tokamak mode without using gas puffing. Magnetohydrodynamic studies on the sharp boundary model of a high beta Tokamak are described. Author (ESA)

N80-11921# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).

ON THE BOUNDARY LAYER BETWEEN A FLOWING PLASMA AND A MAGNETIC FIELD. PART 1. THE CONDITIONS FOR EQUILIBRIUM

L. R. O. Storey and L. Cairo Oct. 1978 65 p refs

(CRPE-NT-63-Pt-1) Avail: NTIS HC A04/MF A01

A qualitative study is made of a plane charge-neutral magnetopause separating a field-free plasma from a plasma-free magnetic fields, in the case where the plasma is flowing parallel to the applied field. It is shown that the existence of small-scale equilibrium depends on boundary conditions which are governed by the large-scale structure of the system. On certain conditions, which are defined, equilibrium is possible at all flow speeds. For a class of structures characterized by approximately axial flow, these conditions cannot be satisfied if the plasma encloses the magnetic field, but can if the magnetic field encloses the plasma. They are satisfied most naturally if, in addition, the magnetopause has the form of a torus. While intended originally as a contribution to magnetospheric physics, results may be more relevant to the high confinement of fusion plasmas.

Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-11922# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.

MNOS BORAM MANUFACTURING METHODS AND TECHNOLOGY PROJECT Progress Report, 1 Apr. 1978 - 31 May 1979

J. E. Brewer and R. C. Lyman Jun. 1979 40 p

(Contract DAAB07-76-C-0048)

(AD-A071413; DELET-TR-76-0048-7; Rept-79-0467; TR-1) Avail: NTIS HC A03/MF A01 CSCL 20/12

A manufacturing methods project has been initiated to establish a pilot production line for metal nitride oxide semiconductor (MNOS) block oriented random access memory (BORAM) multichip hybrid circuits. This report presents an analysis of test results from an 8900 hour endurance-retention experiment. GRA

N80-11923# Cornell Univ., Ithaca, N. Y. School of Electrical Engineering.

ELECTRIC CURRENT CONTROLLED LIQUID PHASE EPITAXY OF COMPOUND SEMICONDUCTORS FOR MICROWAVE DEVICES Final Report, 1 Oct. 1978 - 31 May 1979

Lester F. Eastman, Colin E. C. Wood, and Bart VanRees 1979 26 p refs

(Contracts AF-AFOSR-2929-76; AF Proj. 2306)

(AD-A072643; AFOSR-79-0913TR) Avail: NTIS HC A03/MF A01 CSCL 20/12

A study has been made to determine the growth rate and the mechanism responsible for the growth of InP epitaxial layers while applying an electric current across the melt-substrate interface, maintaining a constant overall temperature. The object of the study was to produce layers of thicknesses up to 100 micrometers with a constant residual impurity profile for impurity levels of approximately 2 x 10 to the 15th cu cm for use in Gunn diodes and other microwave devices. GRA

N80-11924# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.

RESONATORS FOR ACCELERATION ENVIRONMENTS

Theodore Lukaszek and Arthur Ballato Jun. 1979 39 p refs

(DA Proj. 1L1-61101-A-01A)

(AD-A072741; DELET-TR-79-1C) Avail: NTIS HC A03/MF A01 CSCL 09/1

Singly rotated AT cut plates are most often used for frequency control in applications where moderate and high precision is required, but recent developments point to a greatly expanded role for doubly rotated cuts. Virtually all of these thickness mode cuts are of the form of thin circular discs mounted on their edges. Any forces communicated between the mounting supports and the quartz plate produce high stresses and stress-gradients resulting in significant frequency perturbations. This report describes crystal plate designs having a prescribed

lateral contour for singly and doubly rotated plates. These designs provide a relatively large portion of the periphery for mounting, such that mounting stresses are greatly reduced with no detriment to the force immunity of the older-type mounts. GRA

N80-11925# Stanford Univ., Calif.
STUDY OF THE ELECTRONIC SURFACE STATES OF 3-V COMPOUNDS Semiannual Progress Report, 1 Oct. 1978 - 31 Mar. 1979
W. E. Spicer and I. Lindau 31 Mar. 1979 58 p refs
(Contract N00014-79-C-0072; DARPA Order 3564; NR Proj. 322-078)
(AD-A073014) Avail: NTIS HC A04/MF A01 CSCL 11/6

Although several theories of Schottky-barrier formation have been proposed, none has emerged as the correct general theory which elucidates the mechanism responsible for the barrier formation. Indeed, there may be no such general theory and, at the present time, it seems more appropriate to study limited classes of semiconductor materials. We have chosen the 3-5 compounds for both theoretical and practical reasons. The cleavage faces of GaAS, GaSb, and InP have the advantage that there are no intrinsic states in the band gap. This is in contrast to the more familiar column 4 semiconductors which do have intrinsic surface states in band gap upon cleaving. It was this concept of intrinsic semiconductor surface states in the gap which was used by Bardeen to explain Schottky-barrier formation on Si. However, the presence of these intrinsic surface states in the gap on the clean cleaved Si (111) surface does not rule out the possibility that other mechanisms may be responsible for surface Fermi energy stabilization after deposition of an overlayer. GRA

N80-11926# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Res. Div.
ELIPSOMETRY OF SURFACE LAYERS ON LEAD AND LITHIUM M.S. Thesis
Richard Dudley Peters Oct. 1978 175 p refs
(Contract W-7405-eng-48)
(LBL-8375) Avail: NTIS HC A08/MF A01

Anodic and corrosion films on lead exposed to sulfuric acid and lithium exposed to water were studied using an automatic self compensating ellipsometer. The processes in the growth of surface layers and the factors that determine electrode behavior are discussed. Simultaneous measurement of current and potential is made and scanning electron micrographs of surface layers are examined. A.W.H.

N80-11927# California Univ., Berkeley. Lawrence Berkeley Lab.
ELLIPSOMETRY OF ANODIC FILM GROWTH Ph.D. Thesis
Craig Gordon Smith Aug. 1978 360 p refs
(Contract W-7405-eng-48)
(LBL-8082) Avail: NTIS HC A16/MF A01

An automated computer interpretation of ellipsometer measurements of anodic film growth was developed. A multiple-film model was used to characterize the growth of films which proceeds via a dissolution-precipitation mechanism; the model also applies to film growth by adsorption and nulceation mechanisms. The characteristic parameters for film growth describe homogeneous and heterogeneous crystallization rates, film porosities and degree of hydration, and the supersaturation of ionic species in the electrolyte. Additional descriptions which may be chosen are patchwise film formation, nonstoichiometry of the anodic film, and statistical variations in the size and orientation of secondary crystals. Theories were developed to describe the optical effects of these processes. The growth in alkaline solution of anodic films on silver, cadmium, and zinc is discussed. DOE

N80-11928# California Univ., Berkeley. Lawrence Berkeley Lab.
THE EFFECT OF CRYSTAL GROWTH DIRECTION ON THE ENERGY RESOLUTION OF HIGH-PURITY GERMANIUM DETECTORS
G. Scott Hubbard, E. E. Haller, and W. L. Hansen Oct. 1978 7 p refs Presented at the IEEE Nucl. Sci. Symp., Washington, D.C., 18 Oct. 1978
(Contract W-7405-eng-48)
(LBL-8133; Conf-781033-32) Avail: NTIS HC A02/MF A01

Both [100] and [113] direction high-purity germanium crystals with dislocation densities > 10 to the 4th power/sq cm have been examined by Hall effect, Deep Level Transient Spectroscopy and gamma-ray spectrometer performance. High dislocation density [100] crystals appears to give rise to acceptor levels which cause broadened and/or asymmetric photopeaks. [113] crystals with EPD >10 to the 4th power/sq cm do not show these effects. DOE

N80-11929# Freiburg Univ. (West Germany). Kristallographisches Inst.
ZONE CRYSTALLIZATION UNDER ZERO GRAVITY Final Report
Achim Eyer and Harald Zimmermann Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 191 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1072; GfW-01-E-0064)
(BMFT-FB-W-77-12) Avail: NTIS HC A09/MF A01; ZLDI, Munich DM 39,50

Based on theoretical considerations and after experimenting with several preliminary set-ups (using various radiation sources and focusing geometries), a zone crystallization apparatus was built. It is intended to serve as an experimental model to define the requirements for a SPACELAB version. The central part is a mirror furnace consisting of two adjoining rotary ellipsoids (half-axes a = 100 mm, b = C = 100 mm, volume 6 1), having one common focus. The sample rod to be crystallized is located in this focus while two halogen lamps as radiation sources are located in the other two foci. Approximately 95% of the radiation is focused. The (completely sealed) furnace can be operated under vacuum or a protective gas atmosphere. Temperatures up to 2000 C can be attained depending on the size and properties of the sample. Power consumption is extremely low as compared with conventional heating methods, especially if the very high heating and cooling rates are taken into account. Author (ESA)

N80-11930# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazoni.
AN EXPERIMENTAL APPARATUS FOR MEASURING THE THERMAL ABSORPTION OF GaSe SUB 1-x SUB x COMPONENTS
V. Angelini, M. Casalboni, and P. Vecchia 21 Dec. 1978 18 p refs In ITALIAN; ENGLISH summary
(ISS-T-78/17) Avail: NTIS HC A02/MF A01

The measurement of the optical behavior of mixed GaSe sub 1-x S sub x semiconductors as a function of the parameter x is discussed. A computer assisted analysis of thermal absorption measurements is proposed. A experimental setup for making these measurements is described. A comparison of samples grown by the Bridgman method with those grown using the transport method is suggested and some preliminary results are shown. Author (ESA)

N80-11931# Uppsala Univ. (Sweden). Dept. of Solid State Physics.
[ACTIVITIES OF THE DEPARTMENT OF SOLID STATE PHYSICS] Annual Report
Feb. 1978 26 p refs
(UPTEC-78-08-R) Avail: NTIS HC A03/MF A01

A survey of the present research projects is given. The projects fall within the fields of magnetism, mainly ordered spin structures, itinerant electron magnetism, specific heat, and disordered materials. Inorganic chemistry, quantum chemistry, and physics (Moessbauer spectroscopy) are included. Author (ESA)

N80-11932# Montpellier Univ. (France). Lab. de Physique Mathematique et Theorique.
DIFFERENTIAL DIFFERENCE EVOLUTION EQUATIONS. PART 2: DARBOUSE TRANSFORMATION FOR THE TODA LATTICE
V. B. Mateev and M. A. Salles (Inst. of Exact Mechan. and Optics, Leningrad) 1979 7 p refs
(PM/79/11) Avail: NTIS HC A02/MF A01

The Toda lattice equation is represented in the form of the condition of compatibility of the system of linear equations corresponding to a nonhermitian Lax representation. The

Darboux invariance of this linear system is defined and proved. Results are used to construct formulas for the solutions of the Toda lattice equation. These formulas involving determinants are applicable to an arbitrary initial solution of the Toda equation, for example, to a solution growing at infinity. Author (ESA)

N80-11933# Academy of Sciences (USSR), Moscow. Inst. of Space Research.

CRYSTAL GROWTH FROM THE VAPOR PHASE WITH AN INERT COMPONENT PRESENT

S. I. Aladiev and A. S. Okhotin 1978 7 p refs

(D-268) Avail: NTIS HC A02/MF A01

The rates of crystal growth from the vapor-gas medium were studied. The conditions that are adequate to the growth process of the diffusion zone are discussed. Whether the crystal growth rate is determined by transporting the substance to the boundary with phase transition or by chemical reaction rate is examined. It is assumed that both the phase transition and the chemical reaction rate develop rather quickly and are not the limiting stages. Author (ESA)

N80-11934# Academy of Sciences (USSR), Moscow. Inst. of Space Research.

INVESTIGATION OF THE STRUCTURE OF Te-Se SOLID SOLUTIONS OBTAINED IN DIFFERENT GRAVITY CONDITIONS ONBOARD THE SALYUT-6 STATION AND IN THE CENTRIFUGE

Y. S. Avraamov (Moscow Inst. of Steel and Alloys), E. N. Kachanov (Moscow Inst. of Steel and Alloys), S. B. Felgina (Moscow Inst. of Steel and Alloys), G. E. Ignatjev, and A. S. Okhotin 1978 4 p

(D-269) Avail: NTIS HC A02/MF A01

The structures of Te-Se solid solutions obtained onboard the Salyut-6 station (zero-gravity conditions), on earth, and in a centrifuge with the force field at 10 g are compared. The structures of transverse and longitudinal specimens and of freely crystallized surfaces are given. Ingots obtained under microgravity differ even externally from those obtained on earth and in the centrifuge. The considerably macroporous surface of ingots grown in space is most noticeable. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-11935# Braun (C. F.) and Co., Alhambra, Calif.

EXPERIMENTAL ENTHALPIES FOR A MIXTURE OF 80 MOLE PERCENT ISOBUTANE IN ISOPENTANE Final Report

C. R. Koppany and J. M. Lenoir Mar. 1979 52 p refs Sponsored by Electric Power Research Inst.

(EPRI Proj. 928-4)

(EPRI-ER-1034) Avail: NTIS HC A04/MF A01

Seven enthalpy isobars were measured for a nominal mixture of 80% isobutane/20% isopentane. A phase envelope was constructed for use in the design of a turbine expander and the heat exchangers for a geothermal power plant. The dew point values for the phase envelope are discussed for the region near the critical. DOE

N80-11936# California Univ., Berkeley. Lawrence Berkeley Lab.

THERMODYNAMICS OF HIGH TEMPERATURE BRINES

Kenneth S. Pitzer, D. J. Bradley, P. S. Z. Rogers, and J. C. Peiper Apr. 1979 40 p refs Presented at the 177th ACS Natl. Meeting, Honolulu, Hawaii, 1 Apr. 1979

(Contract W-7405-eng-48)

(LBL-8973; Conf-790415-32) Avail: NTIS HC A03/MF A01

Osmotic and activity coefficient data and enthalpy and heat capacity data for NaCl solutions at saturation pressure water from 0 to 300 C and to saturation composition simultaneously fit to a 30 parameter equation, are presented. Calculated values of the osmotic coefficient, the activity of water, the activity of NaCl, and the heat capacity, enthalpy and entropy of the solution are discussed. DOE

N80-11937# Addis Translations International, Portola Valley, Calif.

CONSTRUCTION OF THE EQUATION OF STATE FOR CHEMICAL COMPOUNDS

N. N. Kalitkin Mar. 1979 66 p refs

(UCRL-Trans-11474) Avail: NTIS HC A04/MF A01

A method is presented for construction of interpolation equations, decribing the thermodynamic function of matter over a very broad range of temperature (from room temperature to some millions of degrees) and densities (from gas to a supercompressed state). The equations are constructed using calculations, based on various models of the atom produced in this work, and a large body of models of the atom produced in this work, and a large body of experimental data. As an example, the equation of state of H2O and NaCl is found; the mean-square error of the equation is approximately 5%. DOE

N80-11938# Oak Ridge National Lab., Tenn.

THERMODYNAMIC ASSESSMENT OF OTEC OPEN-CYCLE POWER SYSTEMS

F. C. Chen 1979 6 p refs Presented at the ISA Modeling and Simulation Conf., Pittsburgh, 27 Apr. 1979

(Contract W-7405-eng-26)

(CONF-790459-2) Avail: NTIS HC A02/MF A01

The thermodynamic process of the open cycle is presented and the recent power system studies on the subject are summarized. Based on the range of operating parameters that have been established in the recent system design studies, an optimal thermal performance model is developed. The modeling results for the case studied indicate that low flashdown temperature and higher water velocity in smooth condenser tubes maximize the net power per unit condenser heat transfer surface area. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N80-11939 International Institute for Applied Systems Analysis, Laxenburg (Austria).

SPATIAL POPULATION ANALYSIS: METHODS AND COMPUTER PROGRAMS Final Report

Frans Willekens and Andrei Rogers Nov. 1978 311 p refs

(IIASA-RR-78-18) Avail: Issuing Activity

An integrated methodology for spatial (or multiregional) demographic analysis is reviewed. The FORTRAN 4 codes for the computer programs and a user's manual for implementing this methodology are given. Programs included are the multiregional life table, multiregional demographic projections, fertility and mobility analyses of both life table and stable populations, stable population analyses, the spatial reproductive value, and the analysis of alternative paths to spatial zero population growth. The focus is on the interpretation of the output. The user's manual describes steps to be taken in the preparation of the data deck. Author (ESA)

N80-11940*# Hampton Inst., Va.

SUMMER RESEARCH FELLOWSHIP PROGRAM

Geraldine C. Darden, comp. Oct. 1979 41 p

(Contract NAS1-14832)

(NASA-CR-159153) Avail: NTIS HC A03/MF A01 CSCL 05A

Significant accomplishments reported include uniaxial compression tests of high strength graphite-epoxy laminates. The results show that Young's modulus and fracture stress depend upon the specimen's dimensions. Also presented are: an investigation of robot vision; estimation of spectral signatures of algae from the airborne lidar oceanographic probing equipment; impact tests on polymeric compounds; calibration of quartz crystal

microbalance; and a profile of naturally occurring hydrocarbons.
M.M.M.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-11941# Ohio Public Utilities Commission, Columbus.
DEMAND MANAGEMENT DEMONSTRATION PROJECT. STAGE 1: DEVELOPMENT OF RESIDENTIAL LOAD CHARACTERISTICS. STAGE 4: DEMONSTRATION OF RESIDENTIAL INCREMENTAL COST PRICING IMPLEMENTED BY TIME-OF-DAY METERING Final Report, Jan. 1979
Apr. 1979 144 p
(Contract EC-75-F-01-8072)
(HCP/88072-01) Avail: NTIS HC A07/MF A01

Several load-management technologies were used in order to gather data necessary for further implementation, gain insight into customer reactions to the various techniques studied, and develop the computer codes necessary to process such data. The results are consistent with economic theory and will contribute to the further development of effective pricing structures for electricity. The customers on the time-of-day rate responded by reducing their peak-period consumption significantly below that of comparable control-group customers. Total energy use by customers in the pricing group declined about 3.5%. Customers in the time-of-use and radio-controlled groups reacted favorably to the techniques. DOE

N80-11942# Mathematics and Computation Lab., Washington, D. C. Information Science Div.
ZERO BASE BUDGET SOFTWARE Final Report
Nathan J. Ray Jun. 1979 118 p
(PB-298732/9; GSA/FPA/MCL-TM-283) Avail: NTIS HC A06/MF A01 CSCL 05A

This manual contains descriptions of software modules which may be used to facilitate the physical preparation of budgets using the Zero Base Budget concept. The software includes facilities for entering and manipulating decision packages, rank tables, staffing tables, and object class tables. The manipulation facilities include the capability to obtain resource summaries by organizational elements or by program area. The Zero Base Budget Software executes on the PDP 11/45 computer under control of the STAMOS operating system. GRA

82 DOCUMENTATION AND *INFORMATION SCIENCE*

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N80-11943# Committee on Governmental Affairs (U. S. Senate).
LACK OF ACCOUNTABILITY IN GOVERNMENT PUBLIC *INFORMATION AND PUBLISHING PROGRAMS*
Washington GPO 1979 95 p refs Rept. for Comm. on Governmental Affairs, 96th Congr., 1st Sess., May 1979
(GPO-45-775) Avail: Comm. on Governmental Affairs

Federal agencies do not know how much they spend to write, print, and distribute government publications. The Monthly *Catalog of U.S. Government Publications* is far from complete because many agencies neglect their reporting responsibilities required under Federal law (title 44). Difficulties in evaluating public affairs government-wide and at the Department of Health, Education, and Welfare are discussed. A survey of selected publications practices of Executive Branch Agencies is included.
A.R.H.

N80-11944# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PERTURBATION METHOD ON THE STUDY OF THE INTERACTION OF THE SOLAR WIND WITH COMETS [METODO DE PERTURBACOES NO ESTUDO DA INTERACAO DO VENTO SOLAR COM COMETAS]
Rene A. Medrano-B. Jul. 1979 15 p refs In PORTUGUESE Presented at the 31st Reuniao Anual da Soc. Brasil. Para o Progr. da Cienc. (SBPC), 11-18 Jul. 1979 Revised
(INPE-1529-RPE/061) Avail: NTIS HC A02/MF A01

A hydrodynamic model as well as one in an interplanetary field B were used to study the solar wind-comet interactions. The problem was solved considering that energies in the B fields were smaller than energies of the solar wind at distances of IUA from the sun. An analysis on the balance of pressure at both sides of the shock waves indicate that the size of the fields where the noise is contained is considerably reduced. First order perturbation equations with a solution based on zero order restored the particles to 3 degrees of freedom.
Transl. by M.M.M.

N80-11945# Denver Research Inst., Colo.
MICROFICHE APPLICATIONS IN AN INDIVIDUALIZED, SELF-PACED LEARNING SYSTEM Final Report, Sep. 1977 - Dec. 1978
James P. Kottenstette Brooks AFB, Tx. Air Force Human Resources Lab. May 1979 50 p refs
(Contract F33615-77-C-0057; AF Proj. 1121)
(AD-A069445; AFHRL-TR-79-6) Avail: NTIS HC A03/MF A01 CSCL 05/9

The microfiche medium offers proven advantages in the management, storage, and retrieval of information, as well as significant cost advantages. The study was directed towards developing microfiche formatting concepts and microfiche production methods to capture the power of the medium for delivery of both text and illustrations within context of the Advanced Instructional System (AIS)--a computer based, multi-media, self-paced instructional program of the Air Training Command at Lowry AFB, Colorado. Specific applications were (a) the conversion of color intensive audiovisual modules to microfiche; (b) the formatting of the microfiche to deliver both primary and alternative track modules in an integrated (multi-track) module, and (c) the use of microfiche in testing and test control. GRA

N80-11946# California Univ., Berkeley. Lawrence Berkeley Lab.
A MANUAL FOR CATALOGING AND INDEXING DOCUMENTS
S. R. Schwartz, S. L. Phillips, and J. J. Perra Jul. 1978 85 p refs Revised
(Contract W-7405-eng-48)
(LBL-4432-Rev-1) Avail: NTIS HC A05/MF A01

The descriptive cataloging and subject indexing rules and methodology needed to process bibliographic information for the National Geothermal Information (GRID) database storage are documented. Data elements which may appear in a bibliographic record are tabulated. Examples of coded data entry forms are included in an appendix. Examples are given of unit records in the database corresponding to one bibliographic reference. DOE

N80-11947# Hanford Engineering Development Lab., Richland, Wash.
AUTOMATED DOCUMENT RETRIEVAL WORKSHOP
Linda Sue Boehmer, Gerald A. Marzyck, Weeona G. Harves, Theresa Humason, June E. Isaacs, Jan R. Jackson, and Gerald W. Main Sep. 1978 128 p
(Contract EY-76-C-14-2170)
(HEDL-SA-1628) Avail: NTIS HC A07/MF A01

Records management establishing microfilm system, aperture card production, keywording, and computerizing the document retrieval system were considered. DOE

N80-11948# Charles River Associates, Inc., Boston, Mass.
DEVELOPMENT OF A MODEL OF THE DEMAND FOR SCIENTIFIC AND TECHNICAL INFORMATION SERVICES *Final Report*
Apr. 1979 119 p

(Grant NSF IST-77-18020)
(PB-297826/0; CRA-385) Avail: NTIS HC A06/MF A01 CSCL 05B

The development and estimation of an econometric model of the demand by scientists for scientific and technical journals and the various ways of obtaining these journals and their articles is considered. The demand for subscription as opposed to library use and for hardcopy as opposed to photocopy are explicitly incorporated into the model. A large sample of physicists was surveyed to collect the data necessary to estimate the model. GRA

N80-11949# Capital Systems Group, Rockville, Md.
DEVELOPMENT OF A PLANNING GUIDE TO INNOVATION IN THE DISSEMINATION OF SCIENTIFIC INFORMATION
John M. Strawhorn Feb. 1979 44 p
(Contract NSF C-950)
(PB-296537/4; NSF/IST-24410/15) Avail: NTIS HC A03/MF A01 CSCL 05B

A concise summary of a project designed to simulate the adoption of useful innovations by scientific and technical (S&T) publishers is given. Publication of a book, development of a specialized document collection and bibliographic data base, creation of a computerized human-resources file, conduct of several working meetings on communications technologies, and a major survey of the policies and practices of U. S. S&T journal publishers are among the topics discussed. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-11950*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COST-EFFECTIVE TECHNOLOGY ADVANCEMENT DIRECTIONS FOR ELECTRIC PROPULSION TRANSPORTATION SYSTEMS IN EARTH-ORBITAL MISSIONS
John D. Regetz, Jr. and C. H. Terwilliger (Boeing Aerospace Co., Seattle, Wash.) 1979 21 p ref Presented at the Fourteenth Intern. Conf. on Electric Propulsion, Princeton, N. J., 30 Oct. - 1 Nov. 1979; sponsored by AIAA and Deut. Ges. fur Luft und Raumfahrt
(NASA-TM-79289) Avail: NTIS HC A02/MF A01 CSCL 05C

The directions that electric propulsion technology should take to meet the primary propulsion requirements for earth-orbital missions in the most cost effective manner are determined. The mission set requirements, state of the art electric propulsion technology and the baseline system characterized by it, adequacy of the baseline system to meet the mission set requirements, cost optimum electric propulsion system characteristics for the mission set, and sensitivities of mission costs and design points to system level electric propulsion parameters are discussed. The impact on overall costs than specific masses or costs of propulsion and power systems is evaluated. A.W.H.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-11951# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1980
Washington GPO 1979 54 p Rept. on H.R. 1786 for the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 11 Jun. 1979
(S-Rept-96-207; GPO-39-010) Avail: US Capitol, Senate Document Room

Budget requests for the fiscal year 1980 by National Aeronautics and Space Adminstration are presented. Appropriations for research and development, construction of facilities, and research and program management are discussed. A.W.H.

N80-11952# General Accounting Office, Washington, D. C. General Government Div.
PERSPECTIVES ON INTERGOVERNMENTAL POLICY AND FISCAL RELATIONS
28 Jun. 1979 52 p
(PB-297280/0; GGD-79-62) Avail: NTIS HC A04/MF A01 CSCL 05A

Intergovernmental policy and fiscal relations are examined. Relationships among Federal, state, and local governments are studied. Perspectives on intergovernmental issues and a forecast of future developments concerning ways to improve the intergovernmental management system are discussed. A.W.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-11953*# National Aeronautics and Space Administration, Washington, D. C.
SMALL TRANSPORT AIRCRAFT TECHNOLOGY. A REPORT FOR THE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION, UNITED STATES SENATE Interim Report
Oct. 1979 77 p refs
(NASA-TM-80813) Avail: NTIS HC A05/MF A01 CSCL 05A

A preliminary assessment of the research and technology that NASA could undertake to improve small transport aircraft is presented. The advanced technologies currently under study for potential application to the small transport aircraft of the future are outlined. Background information on the commuter and shorthaul local service air carriers, the regulations pertaining to their aircraft and operations, and the overall airline system interface is included. A.R.H.

N80-11954*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SURVEY OF ELECTRIC AND HYBRID VEHICLE SIMULATION PROGRAMS Final Report
J. Bevan, D. A. Heimburger, and M. A. Metcalfe Nov. 1978 110 p refs
(Contract EC-77-A-31-1011)
(NASA-CR-162457; HCP/M1011-04) Avail: NTIS HC A06/MF A01 CSCL 13F

Results of a survey conducted within the United States to determine the extent of development and capabilities of automotive performance simulation programs suitable for electric and hybrid vehicle studies are summarized. Altogether, 111 programs were identified as being in a usable state. The complexity of the existing programs spans a range from a page of simple desktop calculator instructions to 300,000 lines of a high-level programming language. The capability to simulate electric vehicles was most common, heat-engines second, and hybrid vehicles least common. Batch-operated programs are slightly more common than interactive ones, and one-third can be operated in either mode. The most commonly used language was FORTRAN, the language typically used by engineers. The higher-level simulation languages (e.g. SIMSCRIPT, GPSS, SIMULA) used by 'model builders' were conspicuously lacking. DOE

N80-11955# Oak Ridge National Lab., Tenn.
ADVANCED METHODS FOR THE TREATMENT OF DOMESTIC SEWAGE
A. L. Compere and W. L. Griffith 1978 29 p refs Presented at the 37th meeting of the Southeastern Assoc. for State Highway and Transp. Serv. Offic., Nashville, 21 Oct. 1978
(Contract W-7405-eng-26)
(CONF-7810108-1) Avail: NTIS HC A03/MF A01

Several methods for the treatment of domestic sewage which

are currently at the bench and large pilot stages of development, may be particularly applicable to state highway rest station problems, which often represent a practicable scale-up. Cross-flow filtration produces a high-quality effluent which might be suitable for lawn watering after disinfection. Anaerobic filter processes, either alone or in conjunction with a tertiary process such as ion exchange, may also provide adequate waste treatment for rest stop applications. DOE

N80-11956# General Electric Co., Schenectady, N. Y.
NEAR-TERM ELECTRIC VEHICLE PROGRAM: PHASE 2: MID-TERM SUMMARY REPORT
Aug. 1978 427 p
(Contracts EY-76-C-03-1213; EY-76-C-03-1294)
(SAN-1213-02; SAN-1294-02) Avail: NTIS
HC A19/MF A01

Developments in the areas of system analysis and design, subsystem analysis and design, and test and evaluation are reported. Significant technical accomplishments which are described include aerodynamic design and testing to achieve an extremely low-drag body design and development of a lightweight vehicle structure which will satisfy the current Federal Motor Vehicle Safety Standards. DOE

N80-11957# Kansas Univ., Lawrence. Dept. of Civil Engineering.
REMOVAL OF LAGOON EFFLUENT SUSPENDED SOLIDS BY A SLOW-ROCK FILTER Final Report, 1973 - 1975
Walter J. OBrien and Ross E. McKinney Jun. 1979 120 p refs
(Contract EPA-68-03-0280)
(PB-297454/1; EPA-600/2-79-011) Avail: NTIS
HC A06/MF A01 CSCL 13B

The removal of algae cells and other suspended solids contained in the effluents from facultative lagoons treating domestic wastewaters by means of rock filters is examined. The operating characteristics of the rock filter systems are presented and evaluated. Biological activity within the rock filter noted by the changes in dissolved oxygen concentrations is discussed. GRA

N80-11958# Culp/Wesner/Culp, Santa Ana, Calif.
WATER REUSE AND RECYCLING. VOLUME 1: EVALUATING
Apr. 1979 197 p
(OWRT Proj. R-0088(7804)(1))
(PB-297283/4; W79-07501; OWRT/RU-79-1) Avail: NTIS
HC A09/MF A01 CSCL 13B

Estimates of the potential for waste water reuse and recycling are presented. Information on water supply, water needs and availability, and waste water discharges is discussed. Existing and proposed waste water reuse facilities are reported. Water quality requirements are described for the following potential reusers of reclaimed waste water: agricultural irrigation, landscape irrigation, steam electric cooling, industrial cooling, and other industrial uses. GRA

N80-11959# Urban Inst., Washington, D.C.
DIRECTIONS TO IMPROVE URBAN TRAVEL DEMAND FORECASTING: CONFERENCE SUMMARY AND WHITE PAPERS Final Report
Louise E. Skinner, ed. 1978 411 p refs Conf. held in Washington, D. C., May 1978 Prepared in cooperation with DTM, Inc., Transport and Road Research Lab., Cambridge Systematics, Inc., Oklahoma Univ., S. G. Associates, Inc., sponsored by UMTA and FHWA
(Contracts DOT-FH-11-9386; DOT-FH-11-9387; DOT-FH-11-9389; DOT-8-3-0032)
(PB-297409/5; FHWA/PL-79/007) Avail: NTIS
HC A18/MF A01 CSCL 13B

Approaches and procedures for improving urban travel demand forecasting are studied. Areas of research examined are the application of time and money budgets to planning, increased understanding of location theory (land use, spatial perception, accessibility measures), development of multinomial supply models, and determination of the temporal and geographic stability of demand and supply models used in transportation planning. Data collection procedures in diary data and household interactions are discussed. A.W.H.

N80-11960# Massachusetts Inst. of Tech., Cambridge.
HYBRID OPTIMIZATION IN URBAN TRAFFIC NETWORKS Final Report, 13 Mar. 1978 - 14 Mar. 1979
Han-Ngee Tan, Stanley B. Gershwin, and Michael Athans Apr. 1979 123 p refs
(Contract DOT-TSC-1456)
(PB-297146/3; DOT-TSC-RSPA-79-7) Avail: NTIS
HC A06/MF A01 CSCL 13B

The hybrid optimization problem, a general theoretical framework for the analysis of a class of traffic control problems, is discussed. The role of individual drivers as independent decision makers is examined in relation to the problem. Different behavioral models for flow distribution are investigated. Necessary conditions for this problem are derived, and a physical interpretation of these conditions is provided. Possible directions for the development of algorithms applicable for solving large scale hybrid optimization problems are proposed. A procedure for computing the upper and lower bounds of the optimal cost of the hybrid optimization problem is outlined. A.W.H.

N80-11961# National Fertilizer Development Center, Muscle Shoals, Ala.
ECONOMICS OF DISPOSAL OF LIME/LIMESTONE SCRUBBING WASTES: SLUDGE/FLYASH BLENDING AND GYPSUM SYSTEMS Final Report, Jun. 1977 - May 1978
J. W. Barrier, H. L. Faucett, and L. J. Henson Feb. 1979 209 p refs
(PB-297946/6; BULL-Y-140; EPA-600/7-79-069) Avail: NTIS
HC A10/MF A01 CSCL 13B

Soil-like landfill material is produced without using purchased additives by blending separately collected flyash with dewatered flue gas desulfurization sludge from a limestone scrubbing system; and by air-oxidation modifications sulfate sludge (gypsum) which is dewatered and discarded without further treatment. Both processes are being developed; neither has been fully demonstrated. The sludge/flyash blending process had a higher capital investment ($36.40/kW) than the other (as well as untreated ponding and three of four chemical processes evaluated in an earlier study) primarily because of high electrostatic precipitator and process equipment costs; however, the process had lower annual revenue requirements (1.64 mills/kWh) than three of the four chemical processes. GRA

N80-11962# Envirex, Inc., Milwaukee, Wis. Environmental Sciences Div.
DEVELOPMENT OF AN EMERGENCY RESPONSE PROGRAM FOR TRANSPORTATION OF HAZARDOUS WASTE Final Report
1979 343 p
(Contract EPA-68-01-3973)
(PB-297438/4; EPA-530/SW-171C) Avail: NTIS
HC A15/MF A01 CSCL 13B

The problems associated with hazardous materials spills due to the anticipated increase in transportation of hazardous wastes are discussed. The capabilities of existing systems and an evaluation of their applicability to hazardous waste spills are presented. Federal and State regulations regarding spill notification, reporting requirements, and clean up procedures are reviewed. GRA

N80-11963# SCS Engineers, Reston, Va.
SAMPLING AND ANALYSIS OF THE AQUATIC ENVIRONMENT IN POTW'S AND THEIR VICINITY Final Report, 1977 - 1978
R. Carr, J. Erlandson, R. Greenspun (EPA, Wash., D. C.), M. Halper (EPA, Wash., D. C.), O. Mitz (EPA, Wash., D. C.), M. Neely (EPA, Wash., D. C.), P. Taylor, and G. Vogel 27 Jun. 1979 92 p refs Prepared in cooperation with Versar, Inc., Springfield, Va.
(Contracts EPA-68-01-4679; EPA-68-01-3852)
(PB-297606/6; EPA-440/4-79-026) Avail: NTIS
HC A05/MF A01 CSCL 13B

The sampling and analysis results of influent, effluent, and sludge in the waters of publicly owned treatment works (POTW) are presented. The water and sediment of the POTWs receiving

waters were tested for 13 heavy metals and 115 synthetic organic compounds. A.W.H.

N80-11964# Environmental Protection Agency, Washington, D.C. Municipal Construction Div.

A HISTORY OF LAND APPLICATION AS A TREATMENT ALTERNATIVE

William J. Jewell and Belford L. Seabrook Apr. 1979 97 p (PB-298227/0; EPA-430/9-79-012; EPA/MCD-40) Avail: NTIS HC A05/MF A01 CSCL 13B

A review was conducted to attempt to determine whether the history of land treatment could assist in explaining the reasons behind the apparent reluctance to use this wastewater treatment option, and to provide a basis of judging its future prospects. The approach to explain the major shifts that have occurred throughout the history of land treatment was to interweave the influences of social-public health concerns, legal issues, and technological developments. Surveys of land treatment system failures showed that most convert from land treatment to discharge technology because of population expansion around the site, and not because of a failure of the renovation capability of the soil. GRA

N80-11965# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

SOUTHEASTERN FORUM ON APPROPRIATE TECHNOLOGY Final Report

Jeffrey S. Tiller, David S. Clifton, Jr., and Robert A. Cassanova Apr. 1979 98 p Conf. held at Atlanta, Ga., 17-18 Sep. 1978 (Grant NSF ISP-78-22994)

(PB-298796/4; GIT-B-519-F; NSF/RA-790007) Avail: NTIS HC A05/MF A01 CSCL 05A

The background and purpose of the forum are described as well as its structure and agenda. Results of the forum are presented and a strategy is proposed for NSF to follow in an appropriate technology program. The specific appropriate technologies that participants believed had the greatest potential for widespread implementation were passive solar energy, cooperative community projects, waterless toilets, an AT extension service, active solar equipment, utilization of local material and human resources in energy, resource recovery plants, conversion of biomass to fuel, recycling centers, techniques for passive and active space cooling, photovoltaics and marketing cooperatives for small farms. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-11966* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

AN EMISSION-LINE SURVEY OF THE MILKY WAY

Robert A. R. Parker, Theodore R. Gull (NASA Goddard Space Flight Center), and Robert P. Kirschner (Mich. Univ.) Washington 1979 224 p

(NASA-SP-434) Avail: SOD HC $15.00 CSCL 03A

The instrumentation used in an examination of the ionization structure of emission nebulae and of the galactic plane in general, is described, as well as the characteristics of the prints obtained. Reasonable exposure times were obtained with the use of an image intensifier and five interference filters isolated the band passes chosen for the survey. A rough map of each field is presented with a print from the Becvar Skalnate Pleso covering the same area. No systematic effort was made to identify and mark each nebulosity. A new supernova remnant was discovered in the field 1 = 65.5 deg, b = + 5 deg using this technique. A.R.H.

N80-11967# Royal Observatory, Edinburgh (Scotland).

SPECTROPHOTOMETRY OF COOL STARS IN THE NEAR INFRARED. RESULTS FOR A REGION IN CASSIOPEIA

K. Nandy, F. Smriglio (Rome Univ.), and R. Buonanno (Rome Astron. Obs.) 1978 19 p refs Reprint from Publ. Roy. Obs. (Edinburgh), v. 9, no. 5 1978 p 125-134 Sponsored by Sci. Res. Council

(ISBN-0-9025-5320-8) Avail: NTIS HC A02/MF A01

The space density of M and C stars was investigated for a region of about 15 square degrees in the direction of Cassiopeia. The spectral classification is based on the relative strength of the TiO bands visible in low dispersion objective prism spectra in the photographic infrared. The infrared/magnitudes were derived from direct plates which are calibrated by photoelectric standards obtained with the twin telescope of the Royal Observatory, Edinburgh. It is found that the stars earlier than M4 and carbon stars tend to concentrate in spiral arm regions whereas the late M stars (M7-M10) are evenly distributed in arm and interarm regions. Author (ESA)

N80-11968# Cambridge Univ. (England). Inst. of Astronomy.

CELESTIAL OBSERVATION AND RELATED WORK Annual Report, 1977-78

1978 38 p refs

Avail: NTIS HC A03/MF A01

Observations centered on quasars and galactic nuclei, galaxies, star clusters, and measurements of stellar radial velocities are reported. Topics covered include clustering and N-body dynamics as well as galactic structure, stellar structure, cosmology, galaxy formation, compact objects, and relativity. As a contribution to astronomical instrumentation, the development of a cooled integrating television system for precision two dimensional photometry continued. The Institute of Astronomy pedagogical activities are also discussed. Author (ESA)

N80-11969# Geneva Observatory (Switzerland).

PHOTOMETRIC PROPERTIES OF G, K AND M STARS IN RELATION TO GALACTIC STRUCTURE AND EVOLUTION

Michel Grenon 1978 33 p refs

(Publ-Ser-B-Fasc-5) Avail: NTIS HC A03/MF A01

During the last ten years, an increasing number of investigations based on photoelectric measurements of G, K and M stars were made in the Geneva photometeic system. The ability of the Geneva system to provide a multi-dimensional classification of the late type stars was tentatively checked on the basis of a small sample of typical objects differing in temperature, luminosity, chemical composition, or showing abundance anomalies. Positive results led to the definition of various programs, tending at first to define precisely the properties of the system, to calibrate it in the various obtainable physical parameters, and to apply these calibrations to investigations mainly in the fields of stellar classification, local galactic structure, and chemical evolution. The main properties of the Geneva system are summarized based on these results and some examples of applications are given. Author (ESA)

N80-11970# Geneva Observatory (Switzerlnd).

THE MEASUREMENT OF STELLAR RADIAL VELOCITY BY OPTICAL CORRELATION [MESURES DE VITESSE RADIALES STELLAIRES PAR CORRELATION OPTIQUE]

J. L. Poncet 1978 162 p refs In FRENCH; ENGLISH summary

(Publ-Ser-B-Fasc-6) Avail: NTIS HC A08/MF A01

A stellar radial velocity instrument is described. This fully computer controled instrument uses an optical correlation technique, between the stellar spectrum and a spatial filter. An optical method of partitioning the spectrum allows the use of a large spectral range (lambda lambda 360-5200 A) and at the same time takes into account the problem of the variation of the Doppler shift with lambda. The spatial filter is studied and possible sources of systematic and random errors are discussed. Using a one meter Cassegrain telescope, one can determine velocities for stars at least as faint as m sub v = 12 with a precision of about 1 km/sec in less than 10 minutes. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-11971# *Academy of Sciences (USSR), Moscow. Inst. of Space Research.*
POLARIZATION AND ANISOTROPY OF THE RELICT RADIATION IN AN ANISOTROPIC UNIVERSE
M. M. Basko and A. G. Polnarev 1979 20 p refs
(PR-486) Avail: NTIS HC A02/MF A01

A rigorous solution in the first order with respect to anisotropy is obtained for the equation of polarized radiation transfer in a homogeneous anisotropic universe with a flat co-moving space. The degree of polarization of the background radiation is shown to be very sensitive to the recombination dynamics and to the secondary reheating epoch. Provided that a quadrupole anisotropy of the background radiation is established, the measurements of the degree of its polarization will enable us to set severe limitations on the conditions of secondary ionization. Author (ESA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-11972*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACE MISSIONS TO COMETS
M. Neugebauer, ed. (JPL), D. K. Yeomans, ed. (JPL), J. C. Brandt, ed., and R. W. Hobbs, ed. *Washington 1979 229 p refs Conf.* held at Greenbelt, Md., Oct. 1977
(NASA-CP-2089) Avail: NTIS HC A11/MF A01 CSCL 03B

The broad impact of a cometary mission is assessed with particular emphasis on scientific interest in a fly-by mission to Halley's comet and a rendezvous with Tempel 2. Scientific results, speculations, and future plans are discussed. For individual titles, see N80-11973 through N80-11979.

N80-11973*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SCIENTIFIC NEED FOR A COMETARY MISSION
Fred L. Whipple *In* NASA. Goddard Space Flight Center Space Missions to Comets 1979 p 1-31 (For primary document see N80-11972 02-91)
Avail: NTIS HC A11/MF A01 CSCL 03B

Known facts about comets are reviewed including their organic and inorganic content. Photographs are used to show the differences in the physical appearances of the three types of comets. Space missions will provide the opportunity to determine the sequence of events that led to their formation and that of the solar system; how volatiles arrived on earth; and the basis for the existence of life on earth; and the source of the outer planetary system. A.R.H.

N80-11974*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
CONNECTIONS BETWEEN COMETS AND PLASMAS IN SPACE
Frederick L. Scarf *In* NASA. Goddard Space Flight Center Space Missions to Comets 1979 p 33-58 refs (For primary document see N80-11972 02-91)
Avail: NTIS HC A11/MF A01 CSCL 03B

The dynamical processes in the cometary system represent unusual examples of very important, widespread natural phenomena. Topics covered include: (1) the comet as an obstacle in the solar wind; (2) the nature of the plasma flow; (3) collisionless shocks; and (4) plasma processes in the comet tail. A.R.H.

N80-11975*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMETS: COSMIC CONNECTIONS WITH CARBONACEOUS METEORITES, INTERSTELLAR MOLECULES AND THE ORIGIN OF LIFE
Sherwood Chang *In* NASA. Goddard Space Flight Center Space Missions to Comets 1979 p 59-111 refs (For primary document see N80-11972 02-91)
Avail: NTIS HC A11/MF A01 CSCL 03B

The ions, radicals, and molecules observed in comets may be derived intact or by partial decomposition from parent compounds of the sort found either in the interstellar medium or in carbonaceous meteorites. The early loss of highly reducing primitive atmosphere and its replacement by a secondary atmosphere dominated by H2O, CO2, and N2, as depicted in current models of the earth's evolution, pose a dilemma for the origin of life: the synthesis of organic compounds necessary for life from components of the secondary atmosphere appears to be difficult, and plausible mechanisms have not been evaluated. Both comets and carbonaceous meteorites are implicated as sources for the earth's atmophilic and organogenic elements. A mass balance argument involving the estimated ratios of hydrogen to carbon in carbonaceous meteorites, comets, and the crust and upper mantle suggests that comets supplied the earth with a large fraction of its volatiles. The probability that comets contributed significantly to the earth's volatile inventory suggests a chemical evolutionary link between comets, prebiotic organic synthesis, and the origin of life. A.R.H.

N80-11976*# *Center for Astrophysics, Cambridge, Mass.*
COMETS, CARBONACEOUS CHONDRITES, AND INTERSTELLAR CLOUDS: CONDENSATION OF CARBON
G. B. Field In NASA. Goddard Space Flight Center Space Missions to Comets 1979 p 113-137 refs (For primary document see N80-11972 02-91)
Avail: NTIS HC A11/MF A01 CSCL 03B

Comets, carbonaceous chondrites, and interstellar clouds are discussed in relation to information on interstellar dust. The formation and presence of carbon in stars, comets, and meteorites is investigated. The existence of graphite in the interstellar medium, though it is predicted from thermodynamic calculations, is questioned and the form of carbon contained in comets is considered. A.W.H.

N80-11977*# Toledo Univ., Ohio. Dept. of Physics and Astronomy.
SCIENTIFIC RETURNS FROM A PROGRAM OF SPACE MISSIONS TO COMETS
A. H. Delsemme *In* NASA. Goddard Space Flight Center Space Missions to Comets 1979 p 139-178 refs (For primary document see N80-11972 02-91)
Avail: NTIS HC A11/MF A01 CSCL 03B

A program of cometary missions is proposed. The nature and size of interstellar dust, its origin and evolution; identification of new interstellar molecules; clarification of interstellar chemistry; accretion of grains into protosolar cometesimals; role of a T Tauri wind in the dissipation of the protosolar nebula; record of isotopic anomalies, better preserved in comets than in meteorites; cosmogenic and radiogenic dating of comets; cosmochronology and mineralogy of meteorites, as compared with that of cometary samples; origin of the earth's biosphere, and the origin of life are topics discussed in relation to comet exploration. A.W.H.

N80-11978*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
COMET HALLEY AND HISTORY
Brian G. Marsden *In* NASA. Goddard Space Flight Center Space Missions to Comets 1979 p 179-196 (For primary document see N80-11972 02-91)
Avail: NTIS HC A11/MF A01 CSCL 03B

A history of Halley's Comet is presented. Comets Kohoutek and Ikeya-Seki are discussed. A.W.H.

N80-11979*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ION PROPULSION AND COMET HALLEY RENDEZVOUS
Kenneth L. Atkins *In* NASA. Goddard Space Flight Center Space Missions to Comets 1979 p 197-214 (For primary document see N80-11972 02-91)

Avail: NTIS HC A11/MF A01 CSCL 03B

Cometary rendezvous missions using ion propulsion are considered. The characteristics of the ion engine are discussed including the fuel efficiency and acceleration, and the design of the ion engine is described. The operation of the ion drive engine and an overview of its applications are presented. A.W.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-11980# *National Physical Research Lab., Pretoria (South Africa).*

COMPARISON OF EXTRATERRESTRIAL AND EARTH-BASED SOLAR SPECTRAL IRRADIANCE RESULTS

C. J. Kok 1979 12 p refs

(CSIR-RR-342; ISBN-0-7988-1447-0) Avail: NTIS HC A02/MF A01

The uncertainties involved in measuring the solar spectral irradiances and the solar constant are discussed. A comparison of extraterrestial and ground based solar spectral energy distributions is presented and evaluated to resolve some of the uncertainties qualitatively. Normalized standard daylight spectral power distribution as related to correlated color temperature is analyzed. A.W.H.

N80-11981# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

IS THE SUN CONSTANT?

J. B. Blake and D. S. P. Dearborn (Ariz. Univ., Tucson) 30 Oct. 1979 20 p refs

(ATR-79(9552)-4) Avail: NTIS HC A02/MF A01

Models of the solar convection zone were studied. The effect of fluctuations in the mode of energy transport were investigated at different depths in the sun to determine which regions are most effective in causing change. Short term radius fluctuations observed in the model were examined. Possible causes of convective efficiency fluctuations are discussed and the application of this theory to other stars is considered. A.W.H.

N80-11982# Ruhr Univ., Bochum (West Germany). Lehrstuhl fuer Physikalische Chemie 1.

DETERMINATION OF THE SOLAR PHOTON FLUX IN THE RANGE OF FROM 160 TO 220 nM USING THE PHOTOLYSIS OF AMMONIA COMBINED WITH NITRIC OXIDE DETECTION Final Report

Christian Hubrich and Friedrich Stuhl Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1978 30 p refs In GERMAN; ENGLISH summary

(Contracts BMFT-WRT-1075; DFVLR-BPT-01-QV-655)

(BMFT-FB-W-78-12) Avail: NTIS HC A03/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 6,10

As a possible experimental payload on board SPACELAB, the measurement of the solar photon flux in the wavelength range of from 160 to 220 nm is proposed. Emphasis is placed on the role of this flux rate in the formation of ozone in the stratosphere. It is noted that the concentration of stratospheric ozone is controlled by a complex chemical which can be influenced by human activity. The monitoring of ammonia photolysis combined with nitric oxide detection is suggested as an accurate means of determining photon flux at about 200 nm. It is also pointed out that previous determinations of the photon flux do not agree and hence there is a need to use SPACELAB for this purpose. Author (ESA)

N80-11983# Fraunhofer Institut, Freiburg (West Germany).

PROJECT SPECTROSTRATOSCOPE: BALLOON-BORNE SOLAR RESEARCH Final Report

J. Peter Mehltretter, Wolfgang Mattig, and Alvo vonAlvensleben Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1978 166 p refs In GERMAN; ENGLISH summary

(Contracts BMFT-WRK-0274; DFVLR-BPT-01-DO-184)

(BMFT-FB-W-78-15) Avail: NTIS HC A08/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 34,70

A historical review of the project development (1961 to 1975) is followed by an outline description of the instrument. More details on the technical problems related to photometry and the quantitative analysis of the observations are then given. Focusing, instrument profile, instrumental polarization, pointing, and guiding stability are discussed. After a brief description of the balloon flight of 17 May 1975, the functioning of critical components and the thermal behavior of the instrument are analyzed. The scientific program for the investigation of photospheric granulation by means of time series integrated light pictures and spectra with high angular and spectral resolutin is described; first results concerning life times temperature fluctuations, and velocities of granules are reported. Author (ESA)

N80-11984# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.

SOLAR-GEOPHYSICAL DATA NUMBER 417. PART 2: DATA FOR NOVEMBER 1978 - OCTOBER 1978 AND MISCELLANEA

Helen E. Coffey May 1979 72 p

(PB-297448/3; SGD-417-Pt-2; NOAA-79061403) Avail: NTIS HC A04/MF A01 CSCL 03B

This comprehensive report provides data for November 1978 on: active regions synoptic solar maps, solar flares, solar radio emission, energetic solar particles and plasma, and solar X-ray radiation. It also provides synoptic charts, abbreviated calendar record and regional flare index for October 1978. The miscellaneous data includes solar radio emission for January and February 1979 and cosmic rays for February 1979. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-11985*# *University of West Florida, Pensacola. Faculty of Physics.*

A COMBINED TLD/EMULSION METHOD OF SAMPLING *DOSIMETRY APPLIED TO APOLLO MISSIONS*

Hermann J. Schaefer 1 Sep. 1979 15 p refs

(Contract NAS9-15417)

(NASA-CR-160367) Avail: NTIS HC A02/MF A01 CSCL 03B

A system which simplifies the complex monitoring methods used to measure the astronaut's radiation exposure in space is proposed. The excess dose equivalents of trapped protons and secondary neutrons, protons, and alpha particles from local nuclear interactions are determined and a combined thermoluminescent dosimeter (TLD)/nuclear emulsion method which measures the absorbed dose with thermoluminescent dosimeter chips is presented. A.W.H.

N80-11986# *Lund Univ. (Sweden). Dept. of Cosmic and* Subatomic Physics.

ISOTOPIC COMPOSITION OF PRIMARY COSMIC RAY *NITROGEN AND OXYGEN WITH CONSEQUENCES FOR* SOURCE MODELS

L. Jacobsson, G. Joensson, and K. Kristiansson 7 Dec. 1978 45 p refs Sponsored by Swed. Nat. Sci. Res. Council

(LUIP-7811) Avail: NTIS HC A03/MF A01

An experimental investigation of the isotopic composition of cosmic ray nitrogen and oxygen is reported. The detector was a stack of nuclear emulsions exposed at about 3 g/sq cm atmospheric depth. The mass determinations were based on photometric track width measurements on stopping nuclei. The energy of the measured nuclei falls in the interval 220 to 450 MeV/nuclean at the top of the atmosphere. The cosmic ray source shows that the nitrogen-oxygen abundances ratio is approximately the same in the source as in the solar system. The results were compared with different hypotheses about the source composition and is found to be in best agreement with

a hypothesis which states that the source matter has approximately the composition of the solar system. Author (ESA)

99 GENERAL

N80-11987# Texas Univ. at Austin. Electronics Research Center.

ELECTRONICS RESEARCH AT THE UNIVERSITY OF TEXAS AT AUSTIN Progress Report, 1 Apr. 1978 - 31 Mar. 1979

Edward J. Powers and Steven I. Marcus, ed. 15 Jul. 1979 102 p refs

(Contract F49620-77-C-0101)

(AD-A072436; Rept-26) Avail: NTIS HC A06/MF A01 CSCL 09/5

This report summarizes progress on projects carried out at the Electronics Research Center at The University of Texas at Austin and which were supported by the Joint Services Electronics Program. In the area of Information Electronics progress is reported for projects involving (1) nonlinear filtering and estimation, (2) electronic multi-dimensional signal processing, (3) electronic control systems, (4) electronic computer system design and analysis and (5) electronic computer software systems. In the Solid State Electronics area recent findings in (1) basic solid state materials research and (2) research on instabilities and transport near surfaces and interfaces of solids are described. In the area of Quantum Electronics progress is presented for the following projects: (1) nonlinear wave phenomena, (2) atomic and molecular electronic processes and (3) high power laser systems. GRA

N80-11988# Brown Univ., Providence, R. I. Materials Research Lab.

STRUCTURAL RELATED RESEARCH Final Report, 1 Jun. 1975 - 31 Mar. 1977

1978 103 p

(Contract N00014-75-C-1019)

(AD-A071416) Avail: NTIS HC A06/MF A01 CSCL 05/1

Contents: Microscopic and Macroscopic Dynamic Plasticity; Fracture of Solids; Inorganic Glasses; Chemisorption on Metallic Surfaces; Chalcogenide Materials; Alloy Design and Synthesis of Microstructure for Specific Properties; Plasmas in Solids; Low Temperature Properties of Materials; Pseudo One-Dimensional Conductors; Other research. GRA

N80-11989# National Academy of Sciences - National Research Council, Washington, D. C. Solid State Sciences Committee.

SUPPORT OF SMALL RESEARCH PROJECTS IN MATERIALS SCIENCE AT UNIVERSITIES Final Report, 1 Aug. 1977 - 20 Jun. 1979

B. N. Gregory 1979 58 p

(Contract F49620-77-C-0135; AF Proj. 2306)

(AD-A071940; AFOSR-79-0838TR) Avail: NTIS HC A04/MF A01 CSCL 20/11

A major question facing the nation's scientific community and makers of science policy, is how to maintain the quality of our scientific programs in the face of shrinking resources, either from budgetary cuts or increasingly sophisticated and costly research needs. To explore this situation the NRC's Solid State Sciences Committee initiated a series of meetings to inquire into the manner in which research is supported in the solid state and materials sciences. The general objectives of the study are to review and enlarge understanding of the role of small research projects in the U.S. solid-state sciences effort, to determine factors that lead to meaningful research projects, and to establish guidelines to aid those who must make decisions concerning the allocation of resources. The intended audience includes both universities and funding agencies. In pursuing this study, the panel was asked to undertake the following general tasks: (1) To assess the role of small research projects in relation to regional and national needs; (2) to determine the factors affecting the production of high-quality research in small projects; and (3) To recommend constructive modes of research organization and required support. GRA

N80-11990# Netherlands Committee for Geophysics and Space Research, Amsterdam.

SPACE RESEARCH IN THE NETHERLANDS, 1977

1978 34 p refs Presented at COSPAR Meeting, Innsbruck, Switz., Jun. 1978

Avail: NTIS HC A03/MF A01

Solar and stellar space research focused on studying electromagnetic and particle radiation from the sun and stars. Work included cosmic X-ray satellite observations, infrared astronomy, magnetospheric measurements, ultraviolet stellar spectroscopy, and solar X-radiation observation. Research in X-ray astronomy was supported by rocket sounding, satellite experiments, balloon experiments, and the development of a prototype detector with high spatial resolution. Ultraviolet photometry was also undertaken. In the field of satellite geodesy, participation in observation programs and methods of geodetic analysis are reported. Author (ESA)

N80-11991# Technical Research Centre of Finland, Espoo.

[REPORT ON FINNISH TECHNOLOGICAL ACTIVITIES] Annual Report, 1978

1979 35 p Original contains color illustrations

Avail: NTIS HC A03/MF A01

Results of research and test programs in building, community, materials, processing, energy, and information processing technologies are reported. Specific topics covered include heat economy of buildings, road friction, plastics, lubricants, ceramics, metallic materials and metal production, biotechnology, food science, mineralogy, and measurement of impurities in flue gases. Other areas discussed include graphical processes, mechanical wood handling, ship building, nuclear engineering, measurement of electrical quantities, and data processing and transmission. K.L.

N80-11992# Deutsche Forschungsgemeinschaft, Bad Godesberg (West Germany).

SPACE RESEARCH IN THE FEDERAL REPUBLIC OF GERMANY, 1978

1978 56 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979 Sponsored by Bundesmin. fuer Forsch. u. Technol.

Avail: NTIS HC A04/MF A01

German space research in 1978 is summarized. Research was undertaken using instruments flown on balloons, rockets, and satellites, often participation in international cooperation programs was involved. Main subjects include aeronomy, ionospheric physics, magnetospheric studies, solar radiation and solar wind, solar system, stellar astronomy, cosmic rays, life sciences, and material sciences. Author (ESA)

N80-11993# Swedish Board for Space Activities, Stockholm.

SPACE RESEARCH IN SWEDEN, 1978

1979 41 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979

Avail: NTIS HC A03/MF A01

Swedish space research is summarized. Research was undertaken using instruments flown on balloons, rockets, and satellites, often participating in international cooperation programs. Main subjects include particle experiments, aurora observation, meteor observation, solar wind, ultraviolet astronomy, infrared astronomy, meteorology, and remote sensing. Author (ESA)

N80-11994# Danish Academy of Technical Sciences, Copenhagen.

SPACE RESEARCH IN DENMARK

1979 13 p Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979 Sponsored by Dan. Min. of Educ.

Avail: NTIS HC A02/MF A01

The 1978 activities of five Danish institutions in the field of space research are summarized. The subjects include cosmic rays, plasma and space physics (GEOS satellite data and sounding rockets were employed), rocket measurement of meteorological parameters, real time reception of meteorological data from satellites, Doppler observations combined with gravitational field determination, and aircraft and satellite remote sensing in the Greenland area. Author (ESA)

N80-11995# Committee on Space Research (COSPAR), Berne (Switzerland).

SPACE RESEARCH IN SWITZERLAND, 1978

1979 22 p Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979 Sponsored by Swiss Natl. Sci. Found.

Avail: NTIS HC A02/MF A01

Swiss space research is summarized. Research was undertaken using instruments flown on balloons, rockets, and satellites, often participating in international cooperation programs. Main subjects include satellite geodesy, middle atmosphere studies, magnetosphere studies, solar wind composition, investigations on fine materials and rocks returned from the moon, solar physics, astronomic photometry, and earth resources studies.

Author (ESA)

N80-11996# *Netherlands Committee for Geophysics and Space* Research, Amsterdam.

SPACE RESEARCH IN THE NETHERLANDS, 1978

1979 33 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979

Avail: NTIS HC A03/MF A01

The 1978 activities of four Dutch working groups in the field of space research are summarized. The main subjects include solar and stellar space research, photometry, satellite astronomy, gamma ray astronomy, X-ray astronomy, infrared astronomy, balloon and rocket sounding, and physics of the interplanetary medium. Author (ESA)

N80-11997# Centre National de Recherches de l'Espace, Brussels (Belgium).

SPACE RESEARCH IN BELGIUM, 1978 [LA RECHERCHE SPATIALE EN BELGIQUE]

1979 25 p refs In FRENCH Presented at 22d COSPAR Plenary Meeting, Bangalore, India, 29 May/Jun. 1979

Avail: NTIS HC A02/MF A01

Belgian research during 1978 and 1979 is summarized. The main subjects include stratospheric and mesospheric models, solar ultraviolet flux, sun-earth relationships, solar wind interaction with planetary atmospheres, aurora ionospheric composition, morphology of metallic ions in the E and F subtropical layers, auroral spectra, ultraviolet stellar flux recording, star classification, star atmospheres, satellite observation analysis, telemetry, solar constant, earth radiation balance, and space geodesy.

Author (ESA)

N80-11998# Royal Society, London (England).

SPACE RESEARCH IN THE UNITED KINGDOM

1979 134 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, 29 May - 9 Jun. 1979 Sponsored by UK Sci. Res. Council

Avail: NTIS HC A07/MF A01

British space research activities are summarized. Research was undertaken using instruments flown on balloons, rockets, and satellites. The main subjects include orbital analysis, plasmaspheric studies, atmospheric physics, ultraviolet astronomy, X-ray astronomy, lunar and meteoritic studies, cosmic ray experiments, solar physics, magnetic field measurements, planetary atmospheres, and remote sensing research. Author (ESA)

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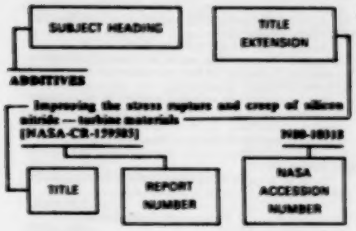

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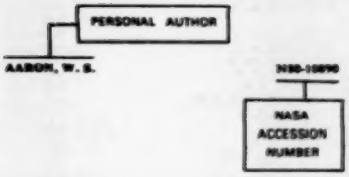

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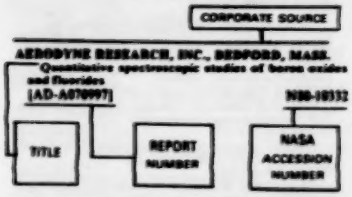

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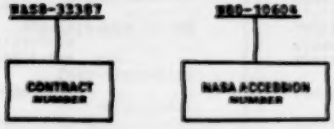

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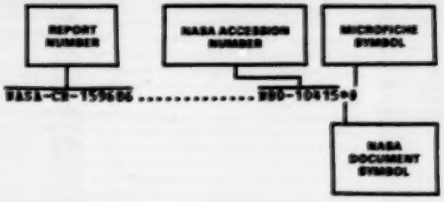

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AFGL-TR-79-0054 ..... ADB-11683 @
AFGL-TR-79-0058 ..... ADB-11681 @
AFGL-TR-79-0063 ..... ADB-11688 @
AFGL-TR-79-0064 ..... ADB-11686 @
AFGL-TR-79-0066 ..... ADB-11687 @
AFGL-TR-79-0075 ..... ADB-11541 @
AFGL-TR-79-0080 ..... ADB-11682 @
AFGL-TR-79-0096 ..... ADB-11726 @

AFHRL-TR-78-90(I) ..... ADB-11772 @
AFHRL-TR-79-6 ..... ADB-11945 @

AFIT-LSSR-19-79A ..... ADB-11095 @

AFIT/DS/PH/79-1 ..... ADB-11332 @

AFLC/XRS-79-137-1 ..... ADB-11088 @

AFWL-TR-78-101 ..... ADB-11474 @
AFWL-TR-78-158 ..... ADB-11196 @
AFWL-TR-78-203 ..... ADB-11338 @
AFWL-TR-78-206 ..... ADB-11496 @
AFWL-TR-79-4001 ..... ADB-11161 @
AFWL-TR-79-4020 ..... ADB-11191 @
AFWL-TR-79-4021 ..... ADB-11192 @
AFWL-TR-79-4065 ..... ADB-11152 @

AFOSR-78-1419TR ..... ADB-11858 @
AFOSR-78-1431TR ..... ADB-11848 @
AFOSR-78-1432TR ..... ADB-11198 @
AFOSR-78-1435TR ..... ADB-11857 @
AFOSR-78-1436TR ..... ADB-11846 @
AFOSR-78-1437TR ..... ADB-11856 @
AFOSR-78-1440TR ..... ADB-11490 @
AFOSR-78-1443TR ..... ADB-11829 @
AFOSR-78-1444TR ..... ADB-11849 @
AFOSR-78-1445TR ..... ADB-11812 @
AFOSR-78-1447TR ..... ADB-11793 @
AFOSR-79-0682TR ..... ADB-11778 @
AFOSR-79-0838TR ..... ADB-11989 @
AFOSR-79-0849TR ..... ADB-11830 @
AFOSR-79-0853TR ..... ADB-11092 @
AFOSR-79-0859TR ..... ADB-11896 @
AFOSR-79-0869TR ..... ADB-11378 @
AFOSR-79-0880TR ..... ADB-11833 @
AFOSR-79-0891TR ..... ADB-11435 @
AFOSR-79-0905TR ..... ADB-11194 @
AFOSR-79-0907TR ..... ADB-11081 @
AFOSR-79-0912TR ..... ADB-11159 @
AFOSR-79-0913TR ..... ADB-11923 @
AFOSR-79-0916TR ..... ADB-11864 @
AFOSR-79-0943TR ..... ADB-11879 @

AFRPL-TR-79-17 ..... ADB-11138 @
AFRPL-TR-79-25 ..... ADB-11240 @

AFSC-TR-79-07 ..... ADB-11302 @
AFSC-TR-79-08 ..... ADB-11303 @

AFWL-TR-77-234 ..... ADB-11836 @
AFWL-TR-77-239-VOL-1 ..... ADB-11510 @
AFWL-TR-77-239-VOL-2 ..... ADB-11511 @
AFWL-TR-78-172 ..... ADB-11297 @
AFWL-TR-78-173 ..... ADB-11298 @
AFWL-TR-78-200 ..... ADB-11292 @
AFWL-TR-78-263163 ..... ADB-11840 @

AIA-78-1 ..... ADB-11076 @

ALC-4158-1 ..... ADB-11626 @

AMRRC-TR-79-12 ..... ADB-11090 @
AMRRC-TR-79-14 ..... ADB-11149 @
AMRRC-TR-79-33 ..... ADB-11150 @

AMRL-TR-78-126 ..... ADB-11780 @
AMRL-TR-79-13 ..... ADB-11308 @
AMRL-TR-79-16 ..... ADB-11055 @
AMRL-TR-79-29 ..... ADB-11335 @
AMRL-TR-79-35 ..... ADB-11781 @
AMRL-TR-79-59 ..... ADB-11786 @
AMRL-TR-79-60 ..... ADB-11783 @
AMRL-TR-79-61 ..... ADB-11782 @
AMRL-TR-79-62 ..... ADB-11784 @
AMRL-TR-79-64 ..... ADB-11787 @
AMRL-TR-79-65 ..... ADB-11785 @

ANL-ICES-TR-28 ..... ADB-11574 @

ANL-78-42 ..... ADB-11610 @
ANL-78-91 ..... ADB-11358 @

ANL/EES-CP-30 ..... ADB-11619 @
ANL/EES-TR-28 ..... ADB-11576 @
ANL/EES-TM-32 ..... ADB-11577 @
ANL/ICES-TR-27 ..... ADB-11571 @
ANL/ICES-TR-29 ..... ADB-11572 @
ANL/ICES-TR-31 ..... ADB-11575 @

APCL-84 ..... ADB-11713 @

APL/JHU-SDO-4100 ..... ADB-11135 @

AR-001-335 ..... ADB-11032 @
AR-001-357 ..... ADB-11187 @
AR-001-369 ..... ADB-11158 @

ARD-R-AG-194-30-79-98 ..... ADB-11658 @

ARBRL-TR-02166 ..... ADB-11239 @

ARCSL-TR-79013 ..... ADB-11895 @

ARI-RN-79-10-1 ..... ADB-11777 @
ARI-RN-79-11 ..... ADB-11776 @

API-TR-79-A2 ..... ADB-11774 @

ARL-AERO-REPT-150 ..... ADB-11032 @

ARL-TR-79-5 ..... ADB-11873 @

ARL/PSU/TR-79-51 ..... ADB-11260 @

ARO-12606.2-P ..... ADB-11243 @
ARO-13252.6-P ..... ADB-11843 @
ARO-13370.2-P ..... ADB-11243 @
ARO-13510.8-E ..... ADB-11042 @
ARO-13857.4-EL ..... ADB-11893 @
ARO-13859.3-MI ..... ADB-11493 @
ARO-13877.3-GSX ..... ADB-11679 @
ARO-14284-7-M ..... ADB-11815 @
ARO-14966.1-A-Z ..... ADB-11040 @
ARO-14980.1-MS ..... ADB-11199 @

AFO-15048.3-2 ..... N80-11160 0
AFO-15641.2-2 ..... N80-11439 0
ABO-1915041.2-2 ..... N80-11471 0

AS-PAPER-305 ..... N80-11712 0

ASRL-TR-193-1 ..... N80-11500 0

ASSA-10/1978 ..... N80-11632 0

ATR-79(9552)-4 ..... N80-11981 0

ATS/PAPER-312 ..... N80-11740 0

AVD-TR-79-001-VOL-1 ..... N80-11722 0
AVD-TR-79-001-VOL-3 ..... N80-11721 0
AVD-TR-79-001-VOL-4 ..... N80-11720 0

BAC-TR-14067 ..... N80-11470*0

BDC-RD-1979/17 ..... N80-11271
BDC-RD-1979/18 ..... N80-11270

BDR-0143 ..... N80-11296 0
BDR-0149 ..... N80-11295 0

BCL-CR-ZTR-78-5 ..... N80-11112*0
BCL-CR-ZTR-79-4 ..... N80-11787*0
BCL-CR-ZTR-79-5 ..... N80-11533*0
BCL-CR-ZTR-79-6 ..... N80-11532*0

BCR-L-919 ..... N80-11588 0

BDI-613-1841-REV N80-11448 0
BDI-613-1890-REV N80-11232 0
BDI-613-1927-REV N80-11476 0
BDI-613-1930-REV N80-11350 0
BDI-613-1943-REV N80-11354 0
BDI-613-1952-REV N80-11349 0
BDI-613-1953-REV N80-11355 0
BDI-613-2022-REV N80-11356 0
BDI-613-2030-REV N80-11357 0
BDI-613-2033-REV N80-11233 0
BDI-613-2039-REV N80-11384 0
BDI-613-2062-REV N80-11153 0
BDI-613-2075-REV N80-11456 0
BDI-613-2076-REV N80-11359 0
BDI-613-2132 ..... N80-11262 0
BDI-613-2165 ..... N80-11207 0

BITC-0001-1 ..... N80-11544 0
BRTC-2180-4 ..... N80-11546 0

BLR/TR/ES-79/05 ..... N80-11755 0
BLR/TR/ES-79/06 ..... N80-11754 0
BLR/TR/ES-79/07 ..... N80-11753 0

BS-BI-8341 ..... N80-11186 0

BRFT-FR-T-78-26 ..... N80-11360 0
BRFT-FR-T-78-48 ..... N80-11630 0

BRFT-FR-R-77-10 ..... N80-11222 0
BRFT-FR-R-77-12 ..... N80-11929 0
BRFT-FR-R-77-13 ..... N80-11313 0
BRFT-FR-R-77-17 ..... N80-11409 0
BRFT-FR-R-77-25 ..... N80-11129 0
BRFT-FR-R-77-46 ..... N80-11113 0
BRFT-FR-R-77-48 ..... N80-11913 0
BRFT-FR-R-78-09 ..... N80-11114 0
BRFT-FR-R-78-11 ..... N80-11702 0
BRFT-FR-R-78-12 ..... N80-11992 0
BRFT-FR-R-78-13 ..... N80-11374 0
BRFT-FR-R-78-14 ..... N80-11115 0
BRFT-FR-R-78-15 ..... N80-11983 0
BRFT-FR-R-78-16 ..... N80-11703 0
BRFT-FR-R-78-19 ..... N80-11410 0
BRFT-FR-R-78-21 ..... N80-11086 0
BRFT-FR-R-78-22 ..... N80-11704 0
BRFT-FR-R-78-29 ..... N80-11130 0
BRFT-FR-R-78-30 ..... N80-11116 0

BRL-24960 ..... N80-11798 0
BRL-24999 ..... N80-11639 0
BRL-25032 ..... N80-11584 0
BRL-25857 ..... N80-11485 0
BRL-50879-VOL-2 ..... N80-11890 0
BRL-50962 ..... N80-11585 0

BR-11013 ..... N80-11125 0

BR79-A167 ..... N80-11829 0
BR80614 ..... N80-11369 0
BR83099 ..... N80-11119 0
BR86975 ..... N80-11121 0
BR87219 ..... N80-11361 0
BR87498 ..... N80-11218 0
BR87500 ..... N80-11096 0
BR90163 ..... N80-11504 0

BULL-T-140 ..... N80-11961 0

CASD-ASF-78-016-PT-3-VOL-1 ..... N80-11111*0

CDAP-TR-054 ..... N80-11387 0

CERL-TR-E-153-VOL-1 ..... N80-11258 0
CERL-TR-E-154 ..... N80-11259 0

CERL-TR-N-41-VOL-2 ..... N80-11871 0

CGOD-TR-79-1 ..... N80-11056 0

CISR-9010-7905-10 ..... N80-11809 0

CISR-TR-10 ..... N80-11809 0

CPD-CS-79-120 ..... N80-11792 0

CRES-ST-85 ..... N80-11629 0
CRES-ST-86 ..... N80-11362 0
CRES-ST-87 ..... N80-11363 0
CRES-ST-88 ..... N80-11819 0

CGR-74-11618 ..... N80-11675 0
CGR-74-11454 ..... N80-11799 0

CONF-780117-92-VOL-2 ..... N80-11890 0
CONF-780418-2 ..... N80-11611 0
CONF-780425-7 ..... N80-11620 0
CONF-780447-1 ..... N80-11596 0
CONF-780501-7 ..... N80-11211 0
CONF-780520-7 ..... N80-11642 0
CONF-780537-3 ..... N80-11447 0
CONF-780537-8 ..... N80-11446 0
CONF-780598 ..... N80-11730*0
CONF-780749-2 ..... N80-11818 0
CONF-780804-12 ..... N80-11408 0
CONF-780923-2 ..... N80-11899 0
CONF-780931-4 ..... N80-11883 0
CONF-780932-5 ..... N80-11204 0
CONF-780941-4 ..... N80-11174 0
CONF-780941-8 ..... N80-11175 0
CONF-780965-1 ..... N80-11451 0
CONF-780966 ..... N80-11911 0
CONF-780977-3 ..... N80-11455 0
CONF-781033-26 ..... N80-11176 0
CONF-781033-32 ..... N80-11928 0
CONF-781039-8 ..... N80-11638 0
CONF-781046-1 ..... N80-11624 0
CONF-781046-5 ..... N80-11628 0
CONF-781046-6 ..... N80-11625 0
CONF-781046-9 ..... N80-11618 0
CONF-781061-3 ..... N80-11798 0
CONF-781063-2 ..... N80-11615 0
CONF-781064-1 ..... N80-11173 0
CONF-781067 ..... N80-11154 0
CONF-781068-2 ..... N80-11205 0
CONF-781076-1 ..... N80-11406 0
CONF-781093-1 ..... N80-11208 0
CONF-781105-79 ..... N80-11910 0
CONF-781110-10 ..... N80-11639 0
CONF-781112-8 ..... N80-11619 0
CONF-781113-6 ..... N80-11637 0
CONF-781114-4 ..... N80-11347 0
CONF-781130-5 ..... N80-11206 0
CONF-781143-1 ..... N80-11229 0
CONF-781197-1 ..... N80-11043 0
CONF-781202-35 ..... N80-11209 0
CONF-781206-4 ..... N80-11697 0
CONF-781214-2 ..... N80-11604 0
CONF-781219-2 ..... N80-11213 0
CONF-781219-3 ..... N80-11212 0
CONF-781235-3 ..... N80-11602 0
CONF-790102-1 ..... N80-11171 0
CONF-790105-1 ..... N80-11616 0
CONF-790232-1 ..... N80-11908 0

CONF-790307-70 ..... PB80-11445 0
CONF-790311-4 ..... PB80-11381 0
CONF-790328 ..... PB80-11580 0
CONF-790328-1 ..... PB80-11603 0
CONF-790358-1 ..... PB80-11579 0
CONF-790362-1 ..... PB80-11586 0
CONF-790366-1 ..... PB80-11497 0
CONF-790402-16 ..... PB80-11517 0
CONF-790405-12 ..... PB80-11246 0
CONF-790405-14 ..... PB80-11590 0
CONF-790408-4 ..... PB80-11696 0
CONF-790415-14 ..... PB80-11449 0
CONF-790415-25 ..... PB80-11168 0
CONF-790415-32 ..... PB80-11936 0
CONF-790431-2 ..... PB80-11817 0
CONF-790431-3 ..... PB80-11798 0
CONF-790433-2 ..... PB80-11543 0
CONF-790434-3 ..... PB80-11245 0
CONF-790450-1 ..... PB80-11207 0
CONF-790459-2 ..... PB80-11938 0
CONF-790461-2 ..... PB80-11587 0
CONF-790502-4 ..... PB80-11797 0
CONF-790505-9 ..... PB80-11402 0
CONF-790525-1 ..... PB80-11796 0
CONF-790527-1 ..... PB80-11348 0
CONF-790548-7 ..... PB80-11866 0
CONF-790605-1 ..... PB80-11592 0
CONF-790615-5 ..... PB80-11518 0
CONF-790620-1 ..... PB80-11382 0
CONF-790629-2 ..... PB80-11865 0
CONF-790630 ..... PB80-11386 0
CONF-790632-2 ..... PB80-11230 0
CONF-790639-1 ..... PB80-11444 0
CONF-790641-4 ..... PB80-11203 0
CONF-790803 ..... PB80-11698 0
CONF-7805149-2 ..... PB80-11795 0
CONF-7805151-1 ..... PB80-11852 0
CONF-7806124-1 ..... PB80-11478 0
CONF-7808106-1 ..... PB80-11442 0
CONF-7809109-1 ..... PB80-11597 0
CONF-7810108-1 ..... PB80-11955 0
CONF-7810115-4 ..... PB80-11454 0
CONF-7810132 ..... PB80-11589 0
CONF-7810154-1 ..... PB80-11622 0

CONTRIB-385 ..... PB80-11654 0
CONTRIB-6006 ..... PB80-11162 0

COO-3137A-343 ..... PB80-11852 0
COO-1198-1216 ..... PB80-11210 0
COO-1198-1234 ..... PB80-11217 0
COO-1340-64 ..... PB80-11730**0
COO-1764-342 ..... PB80-11912 0
COO-2218-119 ..... PB80-11910 0
COO-2383-0053 ..... PB80-11391 0
COO-2640-8 ..... PB80-11883 0
COO-3077-153 ..... PB80-11170 0
COO-4094-17 ..... PB80-11627 0

CRA-385 ..... PB80-11948 0

CRL-60 ..... PB80-11812 0

CRPE-NT-63-PT-1 ..... PB80-11921 0

CRREL-79-15 ..... PB80-11538 0

CSD-2660-FR-D PB80-11240 0

CSIR-RE-1594 ..... PB80-11276 0

CSIR-RR-342 ..... PB80-11980 0

CSIR-SWISK-8 ..... PB80-11801 0

CSIR-TWISK-42 ..... PB80-11835 0
CSIR-TWISK-47 ..... PB80-11842 0
CSIR-TWISK-49 ..... PB80-11828 0
CSIR-TWISK-52 ..... PB80-11761 0
CSIR-TWISK-53 ..... PB80-11841 0
CSIR-TWISK-57 ..... PB80-11531 0
CSIR-TWISK-58 ..... PB80-11840 0
CSIR-TWISK-59 ..... PB80-11838 0
CSIR-TWISK-60 ..... PB80-11839 0
CSIR-TWISK-61 ..... PB80-11803 0
CSIR-TWISK-62 ..... PB80-11802 0
CSIR-TWISK-63 ..... PB80-11827 0
CSIR-TWISK-65 ..... PB80-11837 0
CSIR-TWISK-66 ..... PB80-11836 0

CSR-IR-78-1 ..... PB80-11151 0

CTB-MATS-1979-13 ..... PB80-11860 0

C78-1151.1/201 ..... PB80-11136**0

D-268 ..... PB80-11933 0
D-269 ..... PB80-11934 0
D-277 ..... PB80-11709 0

DABCOR-D-706-316 ..... PB80-11148 0

DCA-5 ..... PB80-11290 0

DDA-EDR-9930 ..... PB80-11092 0

DELET-TR-76-0848-7 ..... PB80-11922 0
DELET-TR-77-2682-F PB80-11330 0
DELET-TR-78-0563-2 ..... PB80-11568 0
DELET-TR-78-2991-1 ..... PB80-11333 0
DELET-TR-79-10 ..... PB80-11924 0

DELNV-TR-76-0830-F PB80-11429 0

DGS-286 ..... PB80-11541 0

DREW/PUB/NICSR-79/127 ..... PB80-11663 0

DR-26 ..... PB80-11631 0
DR-27 ..... PB80-11706 0

DRA-4670T PB80-11299 0

DOE/EIA-0102/50 ..... PB80-11601 0
DOE/ERA-0047 ..... PB80-11593 0
DOE/ERA-0053 ..... PB80-11583 0
DOE/TI-0093 ..... PB80-11751 0
DOE/TT-0093 ..... PB80-11570 0
DOE/FERC-0010 ..... PB80-11251 0
DOE/JPL-1012-22-REV-A PB80-11570**0
DOE/JPL-954833-79/2 ..... PB80-11563**0
DOE/JPL-954847-78/4 ..... PB80-11562**0
DOE/JPL-954854-77/4 ..... PB80-11565**0
DOE/JPL-955083-79/4 ..... PB80-11561**0
DOE/NASA/0058-79/3 ..... PB80-11558**0
DOE/PE-0010 ..... PB80-11621 0

DOT-TSC-RSPA-79-7 ..... PB80-11960 0

DP-MS-78-50 ..... PB80-11208 0
DP-MS-78-73 ..... PB80-11519 0
DP-MS-78-83 ..... PB80-11381 0

DPW-BAR/SRS-78-1 ..... PB80-11551 0

DRDNI-R-78-1-VOL-4 ..... PB80-11437 0

DRDNI-T-79-31 ..... PB80-11441 0
DRDNI-T-79-37 ..... PB80-11126 0
DRDNI-T-79-43-VOL-1 ..... PB80-11063 0

DREP-ZR-79-1 ..... PB80-11872 0

DRIC-TRANS-5359 ..... PB80-11361 0
DRIC-TRANS-5429 ..... PB80-11096 0
DRIC-TRANS-5465 ..... PB80-11218 0

DRL-74/DPD-SE PB80-11569**0

DT-7802-9 ..... PB80-11380 0

DTNSRDC/ASED-79/04 ..... PB80-11075 0

D3-1978 ..... PB80-11526 0
D4-1979 ..... PB80-11875 0
D6-44471 ..... PB80-11098**0
D180-24735-1 ..... PB80-11123**0
D180-25381-1 ..... PB80-11121**0
D180-25402-1 ..... PB80-11122**0

E-065 ..... PB80-11188**0
E-066 ..... PB80-11087**0
E-164 ..... PB80-11143**0
E-178 ..... PB80-11189**0
E-182 ..... PB80-11145**0
E-201 ..... PB80-11376**0
E-203 ..... PB80-11144**0
E-217 ..... PB80-11037**0

E-223 ..... ADA-A033270

ECAC-PR-76-019 ..... ADA-A031275

ECP-79 ..... ADA-A071498
ECP-82 ..... ADA-A073460
ECP-86 ..... ADA-A073370

EMST-D-78023 ..... ADA-A071500
EMST-D-79005 ..... ADA-A071901
EMST-D-79006 ..... ADA-A071501

EPA-430/9-79-012 ..... ADA-A071964
EPA-440/4-79-026 ..... ADA-A071963
EPA-530/SW-171C ADA-A071962
EPA-540/4-79-008B ADA-A071649
EPA-600/2-79-011 ..... ADA-A071957
EPA-600/2-79-081 ..... ADA-A071185
EPA-600/2-79-108 ..... ADA-A071659
EPA-600/3-79-050 ..... ADA-A071662
EPA-600/7-79-069 ..... ADA-A071961
EPA-600/7-79-071 ..... ADA-A071657
EPA-600/7-79-087 ..... ADA-A071660
EPA-600/7-79-088 ..... ADA-A071183
EPA-600/7-79-108 ..... ADA-A071650
EPA-600/7-79-112 ..... ADA-A071652
EPA-600/7-79-117 ..... ADA-A071656
EPA-600/8-79-006 ..... ADA-A071182
EPA-600/8-79-023A ADA-A071670
EPA-600/8-79-023B ADA-A071671
EPA-600/8-79-023C ADA-A071664
EPA-600/8-79-023D ADA-A071665
EPA-600/8-79-023E ADA-A071672
EPA-600/8-79-023F ADA-A071673
EPA-600/8-79-023G ADA-A071640
EPA-600/8-79-023H ADA-A071634
EPA-600/8-79-023I ADA-A071666
EPA-600/8-79-023J ADA-A071667
EPA-600/8-79-023K ADA-A071668
EPA-600/8-79-023L ADA-A071669
EPA-902/8-78-006 ..... ADA-A071655
EPA-903/9-79-005 ..... ADA-A071752
EPA-906/9-79-001 ..... ADA-A071648

EPA/HCD-80 ..... ADA-A071964

EPL-79-2 ..... ADA-A071778

EPRI-EM-746-SR ADA-A071250
EPRI-EM-863 ..... ADA-A071607
EPRI-EM-1034 ..... ADA-A071935

EPRI-RP-920 ..... ADA-A071392
EPRI-RP-1023 ..... ADA-A071201

ES-382 ..... ADA-A071474

ERADCOM/ASL-CR-79-0051-1 ..... ADA-A071690
ERADCOM/ASL-CR-79-0100-2 ..... ADA-A071874
ERADCOM/ASL-DR-1019 ..... ADA-A071719
ERADCOM/ASL-ER-1021 ..... ADA-A071718
ERADCOM/ASL-TR-0031 ..... ADA-A071291

ESA-CR(P)-1176-VOL-2 ..... ADA-A071413
ESA-CR(P)-1210 ..... ADA-A071132

ESA-PSS-52/QRS-329-ISSUE-1 ..... ADA-A071156

ESD-TR-79-43 ..... ADA-A071290
ESD-TR-79-76 ..... ADA-A071124
ESD-TR-79-85 ..... ADA-A071300
ESD-TR-79-159 ..... ADA-A071305

ESL-710300-4 ..... ADA-A071340

ETI-CR79-680 ..... ADA-A071199

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